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XV.—FISH-POISON PLANTS. F. N. HOWES.

In most parts of the world primitive peoples have from time immemorial made use of vegetable products of diverse natures for poisoning or stupefying fish in order to facilitate their capture. The practice is one of great botanical and ethnological interest and has generally attracted the attention of travellers and scientists. With the advance and spread of civilization this method of fishing, condemned on account of the wholesale destruction of fish of all sizes which is involved, has naturally declined, and in some areas, particularly where the practice has been made illegal, it has fallen into complete disuse. In most areas the plants used are collected in the wild state, but there are reasons for supposing that among certain aborigines, particularly in South America and Tropical Africa, the plant or plants used have been cultivated by them for this purpose throughout the ages.

Lists of plants used as fish-poisons have been published by Ernst (1), Radlkofer (2), and Greshoff (3), that of the last-mentioned author containing the largest number of species and being the most generally informative. As these works were compiled for the most part towards the end of last century, some of the less widely spread fish-poison plants are naturally omitted. It is intended in the present article to mention plants more recently recorded as fish-poisons, and also to dwell upon those among the better known ones to which particular interest may be attached.

There is little doubt but that many of these plants are of potential economic value and may in time be put to more profitable use than fish-poisoning. The practical utility of some, notably species of *Derris*, has already been demonstrated in the commercial manufacture of efficient contact insecticides. There are now good reasons for believing that others, especially species of *Tephrosia* and *Lonchocarpus*, could be used equally well for insecticidal purposes if material of the plants were available in sufficient quantity. The number of plants used to any extent as insecticides at the present time is small and comprises probably only Tobacco, Pyrethrum, *Derris* and *Hellebore*. Apart from toxicity to insects other factors have to be borne in mind when considering the possible use of plants as insecticides. One of the most important of these is whether material is likely to be available in quantity, i.e., whether the plant is comparatively quick-growing and easy of cultivation, for it is

seldom that wild sources are satisfactory and can be relied upon for any length of time. Various technical problems have to be confronted in the actual preparation of the extracts. Among these are the securing of efficient spreading, wetting, and adherence when actually applied.

Apart from use as insecticides the possibility exists, in view of the diverse natures of these plants, that the active principles peculiar to certain of them may prove of further use in pharmacognosy and toxicology.

The fact that certain of the fresh-water snails, known to be hosts of, and essential for the complete life cycle of, the organism responsible for schistosomiasis or bilharzia in man, are sensitive to the influence of fish-poisoning species of *Tephrosia*, suggests the possibility of such plants being of use in those areas where the incidence of the disease is high.

Cawston (4, p. 22), working on schistosomiasis in Natal, states "the crushed roots, unboiled, of *Tephrosia macropoda* or *Tephrosia Vogelii*, are very fatal to fresh water snails, and as one in twenty-five million of the former species is said to destroy fish in one hour the local species . . . would appear to be considerably more effective than copper sulphate in freeing pools . . . of bilharzia infection." It is in the warmer parts of the globe, where irrigation is employed on an extensive scale, that bilharzia is most prevalent and widespread, the extensive stretches of water and irrigation canals, etc., being favourable to the snail. Haslem (4, p. 8), in referring to the disease in the Far East, quotes "Thousands of farmers yearly . . . either succumb to an overwhelming infestation, or are compelled by increasing weakness and disability to become a burden on their families and the community (Houghton, 1920). It has been estimated that schistosomiasis is responsible for 25 per cent. of all deaths in Egypt (Griesinger, 1854). More recent observers, however, give a lower figure." The cultivation of green manure crops is common practice in irrigation areas. Many of the leguminous fish-poison plants are quick-growing, and worthy of serious consideration as green manures, some having already proved themselves of value for this purpose. The cultivation of such plants, with subsequent cutting or turning in, in irrigation areas suggests the possibility of their fulfilling a dual role by acting as manures and at the same time counteracting the snail pest.

The genus *Tephrosia* is quite one of the most interesting genera among fish-poison plants, not only on account of the large number of species of a toxic nature which it contains, but on account of the wide range of the genus throughout both hemispheres. Some individual species have become very widely distributed owing to the influence of man. Among these might be mentioned *Tephrosia purpurea* Pers., forms of which are said to be fish-poisons, which occurs now all over the tropics as a weed, even in out-of-the-way islands and in remote parts. The important species of *Tephrosia*

originally used in fish-poisoning in the different continents are quite distinct botanically, though closely related and possessing similar chemical properties. It is peculiar that the early inhabitants of different continents, far removed from one another without any form of communication, should have domesticated or taken into cultivation similar plants, e.g., *Tephrosia toxicaria* Pers. in South America, *Tephrosia Vogelii* Hook. f. in tropical Africa, and *Tephrosia astragaloides* Benth. in Australia, for one and the same purpose—that of stupefying fish.

The method of using these plants for procuring fish varies a great deal in different countries and is dependent also on the degree of virulence of the plant. All parts of the plant may be used, but in most cases a certain part only, such as the bark or root, in which the toxic principle happens to be chiefly located, is utilized. The usual method is for the plant or parts of the plant, after being mashed between stones or finely broken up, to be thrown into a pool or netted-off section of a stream. The poison acts on the respiratory organs of the fish, producing first a stupefying effect and later death, in the event of escape from the infected water being impossible. There are instances where an extract is mixed with some form of bait and is taken by the fish in the form of food. This custom is, however, far less common than the former method. In cases where the poisoning of the water is practised there appears to be a considerable difference with different plants in the time required for stupefaction or death of the fish to occur. With some of the more active forms such as Malayan "tuba" root (*Derris* spp.) and species of *Tephrosia*, fish are affected almost immediately the water is infected; whereas with others several hours may elapse before the fish rise to the surface. A very slow action is characteristic of some of the plants used by the Australian aborigines in obtaining fish from water-holes; the cut branches and leaves are left in the water-holes from twelve to twenty-four hours before poisoning takes place. With plants of this sort the toxic effect on fish is considered to be due to the presence of tannins or saponins rather than to any glucoside or alkaloid. The injurious effect of tannic acid on fish, acting on the respiratory organs, has long been known. However, with most of the better-known fish-poison plants their deleterious action has been proved definitely to be due to the presence of alkaloidal substances.

There is little definite evidence at the present time as to whether different species of fish are affected in differing degrees by these poisons. It is common knowledge among those who have witnessed the use of them that the small fry and younger fish are affected or killed some time before the larger matured individuals. Brown (5), in discussing the use of the bark of the "Dogwood" (*Piscidia Erythrina* L.) in Jamaica, makes an interesting statement with regard to the eel. He states that after being pounded the bark is "mixed with the water in some deep and convenient part of the river or

creek, etc., from which it may spread itself more diffusely around, and in a few minutes after it is well mingled, you'll see the fish, that lay hitherto hid under the neighbouring rocks or banks, rising to the surface, where they float as if they were dead; in which situation they continue for a considerable time; while the smaller fry are all destroyed, and float upon the surface for some days after. The eel is the only fish I have observed that could not be intoxicated with the common doses of this bark, though it affects it very sensibly, for the moment the particles spread where it lies, it moves off and swims with great agility through the water. I have sometimes seen them chased to and fro in this manner for some minutes without being any ways altered."

The fish obtained by the use of these poisons seem to be in no wise rendered unwholesome for food, though a tendency to putrefy sooner than would be the case with unpoisoned fish is frequently referred to in the literature.

The practice is recorded from both temperate and tropical countries but is more general in the latter. The species recorded are not limited to any one group of families but occur among families widely separated phylogenetically, and range in habit from small herbs to large lianas and trees. The family with the largest number of species is no doubt the *Leguminosae*: the *Papilionatae* in particular providing many of the specially virulent forms. In the following discussion species are dealt with according to the continent in which they occur.

AFRICA.

The genus *Tephrosia* figures conspicuously among African fish-poison plants, with such species as *T. Vogelii* Hook f., *T. macropoda* Harv., *T. densiflora* Hook. f., *T. periculosa* Baker, etc. The first-mentioned is of common occurrence, both wild and cultivated, in Tropical Africa, and is now well known in other tropical countries as a green-manure plant or cover-crop. Its toxic properties have been studied by Hanriot (6), Tattersfield (7), and others. The former worker isolated three substances, among which was a white crystalline compound, tephrosin. This proved extremely toxic to fish, a concentration of one in twenty-five million sufficing to kill roach in one hour. Sea-water fish were found to be on the whole more resistant to tephrosin than fresh-water fish, while other animals such as frogs, crustacea, mollusca, worms, etc., proved to be considerably less sensitive. Rabbits, it was found, ate the leaves of the plant without any ill effects, while dogs could take as much as 1 gm. of tephrosin with their food. Intravenous injections, however, proved fatal to both dogs and rabbits, a dose of 0.01 gm. per kilo. body weight proving fatal to a rabbit. With regard to the insecticidal properties of *Tephrosia Vogelii* Hk., Tattersfield (7) has shown aqueous and alcoholic extracts of the leaves and seeds to be highly toxic to the Bean Aphis (*Aphis rumicis* L.), the toxicity being of the same order as that of nicotine. The seeds of the plant are

regarded as being the most toxic portion, possessing 0.3 per cent. tephrosin as against 0.15 per cent. for the leaves and a considerably smaller percentage for the stem.

Tephrosia periculosa Baker has been recorded for fish-poisoning in parts of Tropical East Africa.

The best known fish-poison plant in South Africa is no doubt *Tephrosia macropoda* Harv. known as "lozane." It is common in the coastal grassveld of Natal and extends irregularly over the greater part of South-East Africa. The plant, which is of a more or less trailing habit, is characterised by a somewhat fleshy variously shaped rootstock. It is this portion of the plant that is used, being merely mashed between stones at the side of a pool or stream before use by the Zulus and other tribes. As legislation now exists against its use in Natal it is not employed as much as it was formerly. An infusion of the roots with water was commonly used by settlers in the early days in Natal as a wash for freeing dogs of fleas and ticks.

Another common Leguminous plant utilized in Africa in fish-poisoning is *Mundulea suberosa* Benth. This species, probably as a result of age-long cultivation, has now a very wide range. Apart from its occurrence in the greater portion of tropical and subtropical Africa, it is to be found in Madagascar, India and Ceylon. In northern Nigeria and the Sudan the plant is, according to Chevalier (8), frequently cultivated. The plant is stated to be the source of the Indian fish-poison known as "Soopli" or "Soopee." Its action on fish is rapid, and according to Greshoff the plant has the same type of active principle as Derris. Both bark and seed are used.

The bark of *Erythrophleum guineense* G. Don., well known as one of the West African ordeal and arrow poisons, is also on record as a piscicide, a decoction of the bark being used. The pods of *Cassia Sieberiana* DC., a tree widely distributed in West Africa, are used as a fish-poison in addition to being used medicinally.

The use of the climber *Ophiocaulon cissampeloides* Mast. in fishing in Nigeria and the Cameroons is quoted by some observers (9), the method of using the plant being to half roast thick pieces of the stem and after pounding to cast them into the pool or stream where fish abound. This is the only instance known of a member of the *Passifloraceae* being used for this purpose. Fickendey (10), regards the plant as effective as a fish-poison owing to the presence of free hydrocyanic acid or a cyanogenetic glucoside.

In the *Sapindaceae* a large number of fish-poison plants occur, particularly in the tropics of the New World and in the East. *Paullinia pinnata* L., though recorded as a fish-poison in parts of South America, does not appear to be used as such in West Africa although very prevalent in some areas. Among species reputed to be used in fishing are the following:—*Phialodiscus unijugatus* Radlk., *Sesbania pubescens* DC., *Pentaclethra macrophylla* Benth.,

Schwenkia americana L., *Pycnocomma macrophylla* Benth., *Paulowilhelmia polysperma* Benth., *Ampelocissus pentaphylla* G. et P., *Balanites aegyptiaca* Delile, *Randia nilotica* Stapf, *Zizyphus jujuba* Lam., and *Diospyros* spp. A number of other plants are recorded as piscicides from other parts of Tropical Africa, among which are several species of *Euphorbia*. *Elaeophorbium drupifera* Stapf, which is a common tree in the savannah forest in parts of the Gold Coast and elsewhere in West Africa, is used in rather a peculiar manner. According to Irvine "the white juice of this tree is collected into small shells which are then dropped into holes in rivers where fish abound [presumably in the dry season]. Fish are killed comparatively quickly in this way. The leaves and fruits are sometimes mashed and used."

In the Sudan two species of *Adenium* are used, *A. Hongkel* A. DC. and *A. speciosum* Fenzl., both being known as "Sim-es-Samak" (poison-the-fish). The root of the former species has been recorded as a piscicide on the Benue River in Northern Nigeria by Dalziel. *Adenium speciosum* Fenzl. is a fleshy thick-stemmed aborescent shrub, up to ten feet in height, the juice of which is said to be used also as an arrow-poison. Burt Davy (1906) records the use of *Adenium multiflorum* Kl., a deciduous tuberous-rooted shrub, as a fish-poison by the natives in the low-veld of the north-eastern Transvaal.

According to Cardoso, one of the best known fish-poisons on the Cape Verde Islands is *Frankenia ericifolia* C. Sm. var. *microphylla*, known locally as "Mato-sagro" or "Mato-salema." The plant is mashed up with shrimps or fish in the form of a thick paste, which is then placed in holes in the rocks [presumably at low tide], and as the fish are overcome they are collected and placed in the baskets. Other plants stated by the same author to be used in a similar manner on these islands are *Statice pectinata* Ait. and *Aizoon canariense* L. *Euphorbia chamaesyce* L. is used, but in a rather different manner. Speaking of this plant, known locally as "Trevinha," Cardoso states that after spring tides, when fish have collected in canals and low-lying areas, villagers cast stems and leaves of the plant into such areas and the following day reap a rich harvest of the poisoned fish. In Madeira species of *Euphorbia* are also used, notably *E. mellifera* Ait. and *E. piscatoria* Ait.

Species of *Verbascum* are much better known as fish-poisons in Europe than in Africa. One species (*V. phlomoides* L.), however, is quoted by Rosenthal (26) as used in Abyssinia.

AMERICA.

South America probably possesses a greater number of recorded fish-poisoning plants than any other continent. A few of the more virulent of these plants, especially those occurring in British Guiana, have in recent years been studied from the biochemical standpoint, with a view to ascertaining their insecticidal value, and have yielded interesting results.

An interesting feature about some of these South American species is that they have not yet been recorded away from the precincts of man, and are known only from aboriginal cultivations, it being common practice among certain tribes to cultivate a few plants round their habitations to supply their wants in fishing. Altson, who has made a special study of these plants in British Guiana, lays emphasis on this fact and points out that some species seem never to flower. Over a period of some years spent in British Guiana this observer was unable to find certain of these plants in flower or in fruit in spite of a continual look-out being kept and specimens being frequently seen. The following plants are stated to be known only from native habitations in British Guiana :—*Clibadium sylvestre* (Aubl.) Baill., *Tephrosia toxicaria* Pers., *Euphorbia cotinoides* Miq., *Phyllanthus* sp. A distribution of this sort courts the assumption that these plants have been under cultivation throughout a considerable period. If this is so, one would expect a wide degree of variation to exist within each species, variation extending also possibly to the degree of toxicity.

Two of the most commonly used fish-poisons of British Guiana are those known to the creoles as Black and White Haiari, forest lianas common on both lateritic and sandy soils. Both belong to the genus *Lonchocarpus*, but there is some doubt as to whether each is a distinct species or the one a varietal form of the other. Outwardly the one possesses a greyish and the other a dark-coloured bark, hence the local names of Black and White Haiari. Schomburgk, in his "Travels in British Guiana 1840-44," gives an account of the use of Haiari by the Guiana natives, and refers to the plant as *Lonchocarpus densiflorus* Benth. Schomburgk's original specimen marked "bastard haiari" does not, however, agree with specimens of Haiari collected in British Guiana subsequently, which do not appear to belong to the species *L. densiflorus* Benth. According to Altson the Arawak Indians know the White Haiari by the name of "Haiari" and the Black they call "Wacorocordak." The White is known to the Warrau Indians as "E-Yari" and to the Patamona as "A-Ya." White Haiari is often cultivated by the Arawak and Warrau tribes in the open on sandy and lateritic soils, under which conditions it develops into a straggling shrub. Speaking of Haiari Schomburgk states "When the Indians want to carry out a poisoning expedition, they smash and squash up the roots beforehand with huge wooden clubs and throw the mass into the water at those spots where they notice the fish to be plentiful; in about ten to fifteen minutes its effects are visible upon the scaled denizens. They rise to the surface, spring out of the water, gasp for breath, and then turn belly upwards, in which condition they are caught by hand or shot with the arrow. The small finger-long fry usually die while the larger fish generally recover after a time. . . . That the poison not only acts upon the respiratory organs as can be recognised from the difficulty in gasping for air and widely opened gill covers, but that it affects the nervous system to an equal degree is shown by

the generally dilated pupils of the dying fish." (Roth's translation).

There are abundant references to the use of Haiari or similar poisons in the Guianas. Coudreau (11) mentions in some detail the use of the plant in French Guiana which is referred to as "Nicou," or "Nesi" or "Bois enivrant" and considered to be *Lonchocarpus nicou* DC. Pool (12), in discussing the use of "Nekoe" by Indians in Surinam—referred to as *Lonchocarpus violaceus* Kunth. by Greshoff—concludes that the active principle is closely akin to that of *Derris*, as the following quotation indicates:—"Na onderzoek bleek mij, dat het werkzaam bestanddeel der nekoe in hoofdeigenschappen met derrid overeenkwam."

The name "cube" is used in Peru and parts of Brazil for a virulent fish-poison plant, the botanical identity of which has only recently been definitely established. According to Killip and Smith (13) the plant is without doubt *Lonchocarpus nicou* (Aubl.) DC. These authors encountered the plant in both the wild and cultivated state when on a trip of botanical exploration made into the interior of Peru and across Amazonian Brazil. They state "We found that although several kinds of plants were used as fish poisons, such as *Cracca toxicaria* [*Tephrosia toxicaria*], *Cracca nitens* and one or more species of *Clibadium*, and in Brazil certain species of *Lonchocarpus*, one plant alone (cube) was most commonly cultivated and almost everywhere was said to be the most powerful. Curiously we never discovered this plant (*Lonchocarpus nicou*) in flower or fruit, a circumstance giving rise to interesting speculation." Some of the plantations encountered were said to contain several thousand plants, one centre of cultivation being Yurimaguas, situated on the Huallaga River a few miles from its mouth. In Brazil the plant was found both in the forest and in cultivation at Manáos and Gurupá, and in cultivation at Para. A second species of *Lonchocarpus*, the roots of which were reported as a fish-poison on the lower Amazon, was regarded as a new species and has been described by Killip and Smith as *Lonchocarpus urucu* K. & S. In referring to yet another species of *Lonchocarpus* (also a piscicide) these observers state "Along the south bank of the Rio Negro above Manáos we found a large plantation of a second species of *Lonchocarpus*, *L. floribundus* (Killip and Smith 30041). This was a low shrub, 1 to 1.5 metres high, in fine flower and fruit. The roots were of a softer, more porous texture than those of *Lonchocarpus nicou*, but were said to be quite as effective as a fish-poison."

The active principles of both Black and White Haiari from British Guiana have been studied in some detail by recent workers. Extracts from the stems and roots of both have been found to be highly toxic to insects, due to the presence in not inconsiderable quantity, of a compound identical with tubatoxin (the substance to which species of *Derris* owe their toxicity). The leaves, however, were not found to be toxic at any of the concentrations tested. Less

toxic resins were also isolated from the stems and roots. Tubatoxin and the resins proved to be several times more poisonous to certain insects than nicotine. When tried as a stomach poison extracts of Haiari showed both a toxic and a repellent action to the larvae of the insects tested (14).

Species of *Clibadium* have been recorded frequently under the name of "Barbasco" from several South American countries. In British Guiana the leaves of *Clibadium sylvestre* (Aubl.) Baill., an undershrub known to the Arawaks as "Conami," are mixed with bait and commonly used in fish-poisoning. According to some writers the seed also is used. This species has a wide range in Southern and Central America, and is known and used as a fish-poison more or less throughout.

Another of the better-known plants used in fishing and for insecticidal purposes by aborigines in the tropics of the New World is *Tephrosia toxicaria* Pers. This plant is known to the Caribs as "Onabouboue" and also in British Guiana as "Yarro conalli." Its cultivation, according to Chevalier (8), must have been widespread in the pre-Columbian period. This author shows how, at about the time of the voyage of P. Ch. Plumier (1689-97), the plant was common in the Antilles, but that subsequently it became more and more rare and almost disappeared at about the time of the extinction of the Caribs in the islands. According to Altson, in British Guiana the roots of the plant only are used, but it would appear that elsewhere in South America the aerial parts of the plant are used also. Macfadyen (15), in speaking of the occurrence of the plant in Jamaica and of its uses states "This plant is said to have been originally brought from Surinam, or what is more probable from Africa." An African origin for this species can hardly, however, be looked upon with favour at the present time. An enquiry (14) into the toxic properties of the plant made at the Rothamsted Experimental Station showed the roots to be very toxic, the stems less so, and the leaves to "possess insecticidal properties only in a very slight degree." The roots were considered to be quite as powerful in their action as the roots and stems of "Haiari" and leaves and seed of *Tephrosia Vogelii* Hk. As was the case with these species, both a crystalline and a resinous material was isolated from *Tephrosia toxicaria* Pers. Trials with an alcoholic extract of the roots as a stomach poison on insects gave results similar to those given by Black and White Haiari. The plant has now been introduced to certain Eastern countries, notably Malaya and Ceylon, where it is on trial as a cover-crop.

Other common Guiana fish-poisons are *Euphorbia cotinoides* Miq., a shrub possessing an irritating latex, the leaves and young shoots of which are used, and *Serjania paucidentata* DC. The latter is a small-stemmed liana, the stems of which are used in much the same way as Haiari. A small shrub, *Phyllanthus* sp.—known to the Arawak Indians as "Para-para"—is noted from British Guiana

as a piscicide by Altson, who records it only from aboriginal cultivations. The leaves of the plant are used; the name "Spanish Conami" is sometimes given to it by creoles. Other species of *Phyllanthus* quoted as piscicides in South America by Greshoff are *P. brasiliensis* Muell., Arg. var. *genuinus*, *P. piscatorum* Kunth, *P. epiphyllanthus* L., *P. cladotrichus* Muell. Arg., and *P. Conami* Sw.

The Sand Box Tree of South America, *Hura crepitans* L., has been reported as a fish-poison by many travellers in South American countries, the latex from the trunk, which is procured by tapping, being used. According to Ortega (16), a closely allied species, *Hura polyandra* Baill., is used in a similar manner in parts of Mexico. This author states that in some districts the latex is so much in demand for stupefying fish that there is scarcely a tree that is not annually bled for this product.

The *Sapindaceae* in South America are particularly rich in fish-poison plants, particularly among the genera *Paullinia*, *Serjania* and *Sapindus*. These plants owe their injurious effect on fish to a high saponin content. Macfadyen (15), in dealing with the uses of the fruits of *Sapindus Saponaria* L., states "The fleshy covering of the seeds of this tree, and in a less degree the root, make a lather in water, and serve all the purposes of soap, being very generally employed by the lower classes in washing their coarse linens. Bruised or pounded, and thrown into ponds of water, they intoxicate and kill any fish that may be there."

According to Chestnut (17) the weed *Eremocarpus setigerus* Benth. (*Croton setigerus* Hook.), popularly known as "turkey mullein," is or was used by Indians in California in fish-catching. The early Spaniards were well acquainted with the plant, calling it "yerba del pescado." Another popular name, indicative of the intoxicating action of the plant, is "fish locoweed."

ASIA.

One of the most widely spread and best known of Asiatic fish-poisons is undoubtedly *Anamirta Cocculus* Wight et Arn. (*A. paniculata* Colebr.), the fruits of which have long been known to possess peculiar and poisonous properties. Their use in medicine, under the name of "cocculus indicus" or "Indian berries," chiefly as a stimulant and parasiticide, has long been established. The berries are extensively used in parts of India, Malaysia and the Philippines in procuring fish. Their use for this purpose has even extended to European countries, and it is stated that, as a result of cases of poisoning among those who have consumed fish caught in this way, it has been found necessary in some countries to forbid the sale of the berries except in pharmacies. Cases are on record of poachers making use of the berries for capturing trout on some of the English rivers.

The berries owe their poisonous properties to the presence primarily of picrotoxin and to the alkaloid menisperm. A common

method of using the berries in Eastern countries is to grind them to a powder and then make into a thick paste with boiled rice. In this form a small quantity is sufficient to render fish, birds, and certain animals insensible. As an alternative the berry in a partly crushed state may be thrown into the water.

The *Derris* fish-poisons of Malaya and neighbouring countries are of particular interest on account of the extent to which they are now used in the commercial manufacture of insecticides. Known collectively as "tuba" root, the species most generally used as piscicides and of most promise in connection with insect control are *Derris elliptica* Benth., *D. uliginosa* Benth. and *D. malaccensis* Prain. In these species the toxic substances are located for the most part in the roots and root-bark.

The manner in which "tuba" is used by the Malays in sea-fishing is described by Wray (18) as follows:—"It the root] is pounded or ground fine and mixed with stiff clay and crushed refuse, shrimps or small fish, and the mixture is then made into balls and dried. These balls are thrown into the sea, like ground-bait, and fish eating them become poisoned, rise to the surface, and are caught by the watching fishermen. This way of using it is probably not very harmful, though the same cannot be said of its use in fresh waters." In using "tuba" in rivers and fresh water generally the more usual practice is to pound the roots in water in some form of receptacle, sometimes a half-filled canoe, and then to empty this at the top of an enclosed portion of the river or stream. Sometimes lime is added after pounding in order to make the milky fluid sink and spread more rapidly when poured into the river. As the "tuba" infected water comes down the river the fish swim in a frenzied panic down stream to the second barrier, where they are speared or clubbed. In the construction of the barrier space is sometimes sufficient to allow the smaller fish to pass and escape. The exciting sport of tuba-fishing, which is now illegal in the Federated Malay States, has been described in detail by some writers, notably by Maxwell (19) and by Hose and McDougall (20).

The use of *Derris* as an insecticide was practised in the East long before its appearance in Europe and America. As far back as 1848 attention was directed to the use of "tuba" root as an insecticide by Oxley (21), who stated—in connection with the cultivation of Nutmeg seedlings—"Washing the leaves with a decoction of 'tuba' root is the best remedy I know of for a very small moth-like insect that is apt to infest the young plants, laying its eggs on the leaf." Chinese market-gardeners in Malaya frequently make use of an infusion of the pounded root in water, which is sprayed over the plants or brushed over with a bunch of feathers.

Studies of the toxic principles of the more important species of *Derris*, and of their insecticidal properties, have been made by several workers, notably Tattersfield and Roach (22), and McIndoo, Sievers and Abbott (23). The species investigated were found to

act as both contact insecticides and stomach poisons, and to affect different classes of insects differently according to the development of their nervous systems. According to McIndoo, the powdered root used as a dust was found to be effective under practical conditions against dog-fleas, chicken-lice, mealy bugs or red spiders. Used as a powder in water, with or without soap or other emulsifying agent, it was effective against most of the aphids tested, cabbage-worms (*Auto-grapha brassicae* Riley), potato-beetle larvae and certain caterpillars. Other investigators have found the larvae of *Lepidoptera* and saw-flies to be very susceptible, and mosquito larvae and pupae, fresh-water crustaceans and molluscs to be sensitive also, while certain aphides such as the Bean-aphis (*A. rumicis*) and Woolly Aphis (*A. lanigera*) were resistant to wet application. Wray found that 0.03 per cent. of the green root in water was sufficient to kill fish and that 0.00029 per cent. of the resin was quickly fatal, while 0.00001 per cent. proved fatal in from fifteen to thirty minutes according to the species of fish.

The opinion from observations made in Malaya (24) with cultivated plants is that the fine lateral roots always have a higher toxic content than the large roots and that the toxicity is liable to vary with the age of the plant. In this connection it is stated—"Determinations of the ether extract of roots of *Derris elliptica* Benth. have shown that this variety should be harvested approximately twenty-three months after planting, the amount of toxic substance in the ether extract reaching a maximum about this period. Subsequently the toxic content declines until eventually the root becomes unsaleable." The cultivation of "tuba" root in the Federated and Unfederated Malay States has extended very much during the last few years, and at the present time runs into a few thousand acres.

The most important constituents of "tuba" root have been found to be a white crystalline derivative (tubatoxin), soluble in most organic solvents but insoluble in water, and a resin, both of which are toxic. It would appear that their toxicity to insects depends largely upon their degree of dispersion, though the actual physiological action is not at the present time thoroughly understood. It is regarded as strange that the poisonous constituents of *Derris*, being non-volatile insoluble solids, should be able to function so effectively as contact insecticides.

Tephrosia candida DC., which is now widely distributed in tropical countries as a plantation cover-crop, has been recorded by Gamble (25) as a fish-poison plant in Eastern Bengal and Burma, the bark and leaves being chiefly used. The roots and stems but not the leaves of this species were investigated and reported upon by Tattersfield (14). It would appear that both are toxic, though to a considerably less degree than the roots of *Tephrosia toxicaria* Pers. or leaves of *Tephrosia Vogelii* Hk. The plant is regarded as possessing only very moderate insecticidal properties.

Croton Tiglium L. has been recorded as a piscicide in several Eastern countries, and appears to have been much used by natives of the Philippine and neighbouring islands, where the fruit is sometimes known as "tuba." In the Celebes a common method of using the plant is to grind the fruits up with the strong-smelling root of an aroid (*Homalonema rubra* Hassk.) and scatter upon the surface of the water. The toxic effect is doubtless due to toxalbumin (croton). There seems to be a certain amount of disagreement among authors as to whether fish obtained by using *Croton Tiglium* can be eaten with impunity. Bacon (3, pt. iii, p. 89), speaking of this plant, states - "persons who eat fish poisoned with 'tuba' are not disturbed, although it is considered dangerous to drink water that contains any quantity of it." V. d. Velde, on the other hand, states that in using the fish great care must be taken to clean out thoroughly the entrails, to avoid being affected by the poison: and that the effect of the poison on the fish is sometimes so severe as partly to destroy the internal organs. A large number of other Euphorbiaceous plants, including other species of *Croton*, are in use as fish-poisons in Asia, the more important genera being *Euphorbia*, *Pluggea*, *Securinega*, *Macaranga*, *Excoecaria* and *Sapium*.

The fruits of several species of *Diospyros* from the tropics of both the Old and the New World, are known to be injurious to fish. Referring to a Philippine species Bacon (27) states - "A plant which is endemic, common and widely distributed in the Philippines; the part used being the fruit of the tree, which turns black after a few days' exposure to the air. The natives claim that the fruit is exceedingly poisonous, that it will quickly kill fish, and will even cause a crocodile to leave the water." The fruits of *Diospyros toposioides* King and Gamble are utilized in Malaya and those of *D. montana* Roxb. by the natives of Travancore.

The ripe apple-like fruits of *Randia dumetorum* Lam. are employed in parts of India, the fruits being bruised before being thrown into pools. The following remark of Roxburgh (28) in regard to this species is of interest - "If this is done during the hot season, it is said the fish generally die, but if during the wet or cold season they recover. . . . *Cocculus indicus* [*Anamirta Cocculus* Wight et Arn.] does not grow in these parts nor is it known or used there for this purpose." Other Indian plants whose pulpy fruits are used in a like manner, are *Gynocardia odorata* R. Br. and *Barringtonia acutangula* Gaertn. The genus *Barringtonia* is well represented throughout Polynesia, and a number of species are used as fish-poisons throughout the different islands.

Cleistanthus collinus Benth., a small tree occurring in various parts of India, is well known as a poisonous plant, the dried fruit being known to figure frequently in criminal poisoning cases, and the bark to be used in fish-poisoning. According to Hooper (29) the dried bark contains a high percentage of tannin (31.5 per cent.), and as no trace of an alkaloid or glucoside could be discovered the tannin is regarded as responsible for the injurious action on fish.

In Australia the custom of employing plant poisons in fishing is most noticeable among the aboriginal inhabitants of North-Eastern Australia, though it is recorded also in New South Wales, Victoria, North Australia and Western Australia. In South and Central Australia fish-poison plants are not generally used, as local conditions are unfavourable. The Tasmanians are stated never to make use of piscicides at all, which is strange for an insular people. In New Zealand also their use is regarded as unknown. In this connection the following statement by Hamlyn-Harris and Smith (30) is of interest—"Expert navigators and canoe-builders such as the Maoris never used them. Fish are very plentiful all around the coast, and they probably never experienced any difficulty in obtaining all they required. Mr. Cheeseman, the Curator of the Auckland Museum, has pointed out that it is rather curious, considering the extent to which fish-poisons are employed in Polynesia, but that on the other hand none of the plants used in Polynesia extend to New Zealand, and that they have few poisonous species of their own. This just suggests the idea that the plentiful growth of poisonous shrubs may be one of the reasons why the Malaysians employed fish-poisons universally, in spite of the fact that they too might be regarded as expert navigators, and might have got all the fish they required by more legitimate means." The same authors are inclined to the belief that the practice of fish-poisoning in Australia has arisen independently—by chance observation in the first place—and that the evolution of an empirical knowledge of efficient piscicides has occurred independently of any external influence from Polynesia where the use of piscicides is so common. Considering the universality of fish-poisoning such an assumption appears justifiable. An example of knowledge of toxic properties in plants acquired by chance is afforded by the present-day use of *Asclepias curassavica* L. by aborigines in Queensland. This plant, which is alien to Australia, cannot have been naturalized in that continent very long, and a knowledge of its use in procuring fish cannot therefore have been handed down from one generation to another, but must have been obtained more or less spontaneously.

Among the plants recorded in use as fish-poisons among the aboriginal inhabitants of Australia are a number with very marked astringent or tanniferous properties, such as species of *Acacia* and *Eucalyptus*. The injurious effects of such plants are due to tannins and saponins rather than to the presence of any alkaloid. Their relatively slow action compared with the better-known piscicides supports this view. Maiden (31) mentions several species of *Acacia* used in fish-catching, among which are *Acacia falcata* Willd., *Acacia penninervis* Sieb., and *Acacia salicina* Lindl. var. *varians* Benth.

There are not many references to the use by blacks of the all-pervading *Eucalyptus* vegetation in Australia for fish-catching. One of the earliest is probably that of Sir T. Mitchell (32), who

states —“ There the river (River Lachlan) contained some deep pools and we expected to catch fish, but Piper (a black interpreter) told us that the holes had been recently poisoned, a process adopted by the natives in the dry seasons. . . . All these holes were full of recently-cut boughs of the eucalyptus, so that the water was tinged black.” Speaking of the blacks in the interior of Queensland, Palmer states that small branches of *Eucalyptus microtheca* F. Muell. (the “ Colibah ” or “ Flooded Box ”) are cut up and laid in the water for several days to sicken the fish. This may be the same species as that referred to by Sir T. Mitchell. The following remarks by Roth (33) refer also to the use of *Eucalyptus* though the actual species is not clearly indicated. “ In the Cloncurry Woonamurra, and Leichhard-Selwyn districts, especially with large water-holes, numerous leafy boughs and branches of ‘ gum-tree ’ (‘ mitakoodi,’ ‘ joo-a-ro ’), are utilized for capturing fish. The whole camp of blacks working at it, will start throwing these in first thing in the morning ; during the day the water becomes darker and darker and strongly smelling until the following morning at sunrise, when it is almost black, the fish all lie panting at the surface and are easily caught.”

The Fresh-Water Mangrove, *Barringtonia calyptrata* R. Br. (*Barringtonia racemosa* Gaud.) is reported to have been used by the natives of the Mitchell River, Northern Queensland, the bark being cut into small pieces and severely pounded between stones before being placed in the water. The bark of *Barringtonia speciosa* L. is also used and has been found when tested experimentally (Hamlyn-Harris & Smith) to be very toxic to fish, producing initial extreme excitement and exaggerated movement of the gills. The active principle, however, was not ascertained, the bark being found to be “ alkaloid-, saponin- and practically tannin-free.” The inhabitants of the Mary Anne Islands are said to use this plant extensively and Alvin Seale (34) states “ In former times the natives caught and dried large quantities of fish by its means, a grand fishing fiesta being held at certain seasons of the year. The Spanish authorities, however, finding that this was depleting the waters by killing young as well as old, abolished the method in 1894. When the Americans took possession the law was considered obsolete. By chance, I was present at the first of these fiestas that had taken place for seven years. Fully several hundred people took part in the fishing. An immense pool several hundred feet deep, a short distance inside the reef, was surrounded by a line of seines. At low tide about one barrel of this precious juice was poured into the pool. The effect was almost instantaneous ; hundreds of fishes came gasping and struggling to the top of the water, where they were captured and killed by the natives. No ill-effects seemed to follow the eating of these poisoned fish.” In districts in and around Townsville in Queensland, where the plant is known as “ Arroo ” the fruits are eaten as food. This is strange, as the fruit of this species is used in fish-poisoning in New Britain according to Brown (35), and in the

Bismarck Archipelago, where the islanders cast into the water the ground-up seed which the fish consume and become stupefied (36).

Careya australis F. Muell. is a well-known and effective Australian fish-poison plant which grows plentifully in some areas. The bark is the part employed. It is stated that among the blacks on the Burdekin, a discrimination is made according to whether the water is salt or fresh—the bark of the stem being used in fresh water and that of the root in salt. The bark has been found to be saponaceous (30), infusions showing characteristic frothing at great dilutions and haemolysing at a concentration of 1 : 1000.

Another well-known piscicide in Queensland is *Jagera pseudorhus* Radlk. (*Cupania pseudorhus* A. Rich.), a small tree whose bark possesses a great reputation among the natives as a fish-poison. Interest is attached to this species in that during the War the bark was used as a substitute for “quillaja” bark for producing a head or foam on cordials. In an investigation of the occurrence of saponin in this species Francis (37) has shown saponin to be present in almost all parts of the tree with the exception of the leaves. An infusion of the bark has proved fatal to fish in one hour at a concentration of 1 : 1000, and haemolysis of blood corpuscles occurs at a dilution of 1 : 1400. An infusion of the leaves was found to exercise no notable physiological effect on fish, and the preference for the bark shown by the natives appears therefore to be well-founded. A method of using the bark, observed by Kenny on the Kull River, is as follows:—“The bark is carefully scraped from the tree-trunks and limbs and cooked in native ovens for about half an hour; then, when taken and put into a pond and well mixed in the water still held in dilly-bags, soon acts on the fish.”

It has long been known that certain species of *Tephrosia* are used by Australian Aborigines in obtaining fish. Roth (33) states—“The practice of poisoning the water by special plants and capturing the fish as they rise to the surface is met with in the Cloncurry and Woonamurra districts. The Metakoudi use the “too-ta” (*Tephrosia astragaloides*), a blue-flowered shrub growing about three to four feet high. Its leaves are crushed and bruised, and whole bundles full thrown into the water-hole which may be waist-deep and twenty to thirty feet in diameter; in the course of a quarter or half-an-hour the fish come up to the surface, where they are knocked over by the hunters.” *Tephrosia rosea* F. v. M. is considered to be one of the most effective fish-poisons used in the Cape York Peninsula and is known to Mapoon and Pennefather River natives as “Te-uma.” Another frequently recorded species is *Tephrosia purpurea* Pers. (38), known as a fish-poison in other tropical countries also.

Hamlyn-Harris and Smith (30) experimented with both *Tephrosia rosea* F. Muell. and *T. purpurea* Pers. and found the action on test fish to be precisely similar to that of *T. Vogelii* as described by Hanriot, a concentration of approximately 1 : 1,000,000 of the

final product proving fatal in half-an-hour. They state—"Experimental work on *T. rosea* and *T. purpurea* demonstrates the presence of probably identical bodies in these species. Following substantially the method of Hanriot, extraction with alcohol and distillation of the extract in steam, a pungent yellow oil passed over which is thought to be identical with tephrosol (obtained from *T. Vogelii*) . . . The residue was found to be yellowish and hemi-crystalline, and the residue from evaporation of acetone solution is also markedly crystalline; the crystals being associated with a yellow body from which it was impracticable, with the material available, to completely separate them."

Species of *Diospyros*, as is the case in Asia and Africa, are numbered among the known fish-poisons in Australia, the fresh fruit being used. The best-known species is perhaps *Diospyros hebecarpa* A. Cunn. It is stated with regard to this species (39) -"Members of the Goongangee tribe pound it (the fruit) between two flat stones, the resulting pulp being then placed in a dilly-bag, which is swirled about in the selected creek (fresh or salt water). In fresh water "Tulican" (the Goongangee name) turns the water yellow, in salt water red. As the fish become stupefied they rise to the surface and are usually removed with a spear. In spite of the caustic nature of the fruit the poisoning does not in any way appear to spoil the fish as an article of food. The juice of the fruit brought into contact with the skin produces blistering, and the natives in handling it exercise great care in consequence." Dried fruits were found to be inefficacious as a fish-poison.

A species of *Lonchocarpus* (*L. Blackii* F. Muell.) and three species of *Derris*—*D. involuta* Sprague, *D. trifoliata* Lour. var. *macrocarpa* Domin (= *D. uliginosa* Benth.) and *D. koolgibberah* F. M. Bailey—occur in some of the warmer parts of Australia, chiefly Queensland (40). It is not known whether *L. Blackii* possesses piscicidal properties. There are, however, numerous records of the use of species of *Derris* for stupefying fish in Queensland and on neighbouring islands. Both *Derris trifoliata* var. *macrocarpa* and *D. koolgibberah* were found by Hamlyn-Harris and Smith (30) to be extremely toxic to fish. Speaking of the former these authors state "The experiments of the authors confirm the extreme utility and effectiveness of the plant as a stupefacient. The test fish, first evidencing considerable excitement, rapidly became stupefied and periodically rose to the surface. An infusion of one part of dried stem in one thousand parts of water proved fatal in under an hour. The rapidity of action, it may be surmised, has earned for the plant the name of 'Wild Dynamite' among the natives of Dunk Island." *Derris koolgibberah*, known as "Poison Rope," was found to possess a similar action owing to the established presence of derrid. In this species the presence of saponin was also indicated.

In addition to species already mentioned the following are numbered among recorded fish-poison plants in Australia:—

Garcinia Cherryi Baill., *Pongamia glabra* Vent., *Faradaya splendida* F. Muell., *Alocasia macrorrhiza* Schott., *Polygonum Hydro Piper* L., *Sarcocephalus cordatus* Miq., *Terminalia sericocarpa* F. Muell., *Albizzia procera* Benth., and *Stephania hernandiaefolia* Walp. Hamlyn-Harris and Smith (30) adopt a classification for the plants studied, based on their observed efficiency as piscicides, which is as follows :—

“ Group A.—Effective and rapid in action at great dilution.—*Derris*, *Tephrosia*, *Pongamia*, “Nero,” containing active principles associated with ether-soluble resins. The sapotoxin-containing *Careya*, *Cupania* (*Jagera*), *Faradaya*, *Garcinia*.

Group B.—Poisons of intermediate effectivity.—*Barringtonia speciosa*, *Stephania hernandiaefolia*, alkaloid-containing.

Group C.—Poisons of lesser activity.—Slow in action at higher concentrations or uncertain in action.—*Acacia*, *Albizzia*, *Eucalyptus*, *Thespesia*, *Terminalia*, *Polygonum*.

Group D.—Reputed poisons, found innocuous.—*Sarcocephalus*, *Pleiogynium*, *Alocasia*, *Asclepias* (?).”

EUROPE.

In Europe, particularly the Mediterranean countries, the practice of killing fish by means of toxic plants is a very ancient one and dates back to prehistoric times. Aristotle in his “*Historia animalum*” mentions the use of a plant (probably *Verbascum* sp.) in killing fish. Pliny refers to what is apparently a species of *Aristolochia* for poisoning fish in Italy, and also to a Spurge.

It is interesting to observe that in both Greek and Spanish special verbs exist to denote the practice of fish-poisoning. Ernst points out in this connection that it is significant that similar words should have arisen in Greek and Spanish to express the same use for the same plants without there being any corresponding word in Latin or any ethnological connection between them.

The generic name *Verbascum*—the genus being well known for the fish-poisoning properties of some of its species—is regarded as derived from the Latin “barba” on account of the hairy appearance of members of this genus. The Portuguese or Spanish word “embarbascar” (to fish by poisoning) and “barbasco” are considered to be of similar origin. It is interesting to note that the word “barbasco” in certain South American countries has now come to be used as a general term for any plant that may be known to possess fish-poisoning properties.

Among the more important fish-poisoning species of *Verbascum* are *V. phlomoides* L., *V. sinuatum* L. and *V. Thapsus* L. The parts of the plant used as a rule are the capsules and seeds, which are ground to a powder between stones and cast into the water. The first two of the above mentioned species are well known in Greece. Rosenthal (26) states that in Greece, in addition to the use of the

seeds of *Verbascum phlomoides* L. in stupefying the fish, the fresh plant placed in cellars or buildings has the effect of driving away rats and mice. According to Heldreich (42) *Verbascum sinuatum* L. is commonly known in Greece as "Phlomos," a name given also to a species of *Euphorbia* with fish-poisoning properties. Rosenthal enquired into the poisonous properties of this species of *Verbascum* and found in the dried fruits 6.1 per cent. of a poisonous saponin. In the Northern European species of *Verbascum* saponin was found only in a very small quantity, even its presence in some cases being doubtful. Speaking of species of *Verbascum* Lindley (43) states—"The Muelleins approach *Digitalis* . . . the seeds of *Verbascum Thapsus* and *nigrum* are used by poachers to poison fish, and the flowers of *V. Lychnitis* are sometimes used to destroy mice; the foliage of these plants is acrid and bitterish." *Verbascum Thapsus* L. is mentioned by a number of writers including Rochleder, Cornevin, and Wittstein. The last-mentioned states (44) "Das frische kraut riecht widerlich betäubend; zerquetscht soll es die Fische betäuben und in Italien und Griechenland noch zu diesem Zweck gebraucht werden, ebenso die frischen Blumen und die Samen." *Verbascum crassifolium* Hoffm. is, according to Cardoso, well known as a fish-poisoning plant in Portugal.

In an interesting account by Greshoff (3) dealing with the significance of the genus *Verbascum* in the past, early references to the uses of the plants in medicine and as piscicides are given. They were apparently familiar to early Arabian physicians, and according to Ebn. Baethar, the well-known Arab writer of the thirteenth century, the plant (*Verbascum*) known as "Sikran elkut" was commonly used in fishing in Spain at the time of the Moorish occupation. So general did the practice in this country become that in 1453, and at intervals later, the method was declared illegal and a punishable offence. The Portuguese writer Ficalho (45) states that in Portugal, in the year 1565, a law was made, with severe penalties for infringement, preventing the "casting into rivers or lakes of *Verbascum*, *Daphne*, 'Cocco' (*Anamirta paniculata* Colebr.), chalk or any other material likely to kill the fish." Dodoens, the Belgian botanist of the sixteenth century, refers in an interesting though sceptical manner to the use of what is in all probability *Verbascum* ("Wollecruydt") in his famous herbal. He states that "some wash their hands with the sap of "Wollecruydt" and then place them in the water believing that thereby the fish will come to their hands and allow themselves to be caught" (translation). In Linnaeus' time the fame of *Verbascum* as a medicinal plant had considerably declined and its power of stupefying fish was discredited, though in a later edition of Linnaeus' "Praelectiones in Ordines Naturales" the following occurs—"Verbascum venenatum esse inde apparet, quod globulis farinaceis mixtum pisces necet."

In Sardinia the shaved and mashed roots of *Daphne Gnidium* L. are said to be used in fishing and to be regarded as superior to

Oenanthe, the plant being known in the island as "pateddu." Ernst quotes *Daphne Cneorum* L. as a fish-poison in Spain, the leaves and fruits being chiefly used. *Daphne oleoides* Schreb. is recorded as a fish-poison by Muwaffak and *D. Gnidium* L. by Martius, the last-mentioned species being regarded as only seldom used.

Several species of *Euphorbia* are known as fish-poisons in Greece and neighbouring countries. One of the best known of these is *Euphorbia dendroides* L., the method of use being described by Walpole (46) as follows:—"The inhabitants of Salamis practise a singular method of catching the rock-fish by poisoning or intoxicating them. For this purpose they make use of 'phlomos' or Tree Euphorbia, chopped and macerated and then pushed under the large stones or holes and caverns, where these fishes lie. After a few minutes they rise to the surface of the water and are either enclosed in small nets or are even taken by the hand. The *Euphorbia Characias* is employed for the same purpose and is now called 'thumalos' as well as 'phlomos.' The latter name is also given to *Verbascum sinuatum* which is used at Constantinople and Zante to catch different kinds of fish." In describing the use of *Euphorbia Characias* L. in Greece Landerer (47) states that the fish so procured quickly putrefy and that persons making use of the plant are liable to punishment and imprisonment. Other species of *Euphorbia* mentioned for Southern Europe are *E. amygdaloides* L., *E. Sibthorpii* Boiss., *E. platyphylla* L., *E. aleppica* L., and for central Europe, *E. Esula* L.

The root of *Oenanthe crocata* L. is used in fishing in Sardinia and also, according to some writers, in Portugal. Nobre (48) makes the following remarks concerning this species—"While I was busy collecting I met now and again groups of men and boys carrying baskets on their heads. As it was a Sunday this aroused my curiosity. I suspected that they were going fishing with *Oenanthe crocata* called 'Perrexil,' which is common in the district. As I particularly wished to see this method of fishing I followed and saw a group of men half undressed engaged surrounding a large rock with a net, while others, diving down, placed masses of the root of 'Perrexil,' finely shredded, in the cracks of the rock. Within a short time one saw the fish deserting their hiding-places and swimming hither and thither with great speed in a stupefied manner, some trying to bury their heads in the sand but eventually being caught up in the meshes of the net. The bulk of the fish were quite dead by the time they were packed into the baskets" (translation).

Certain species of *Cyclamen*, notably *C. europaeum* L., *C. neapolitanum* Ten. and *C. latifolium* Sibth., are reputed to possess a poisonous and irritating sap which has been used in stupefying fish. The use of certain species of *Aristolochia* for the same purpose has long been known: among these may be mentioned *A. Clematitis* L., *A. rotunda* L. and *A. pallida* Willd. References to the use of the leaves and branches of the Yew, *Taxus baccata* L., in various parts of Europe have been made by certain writers. Van der Harst (41) in

his treatise on the Yew gives various historical notes. It is stated that as early as 1212 the use of Yew in fishing was forbidden by Kaiser Frederick II, the penalty for anyone committing the offence being one year's hard labour. *Hyoscyamus niger* L. appears in Ernst's list of fish-poison plants, and according to Day is made use of in India, though information as to the manner of employment is not given.

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XVI.—DECADES KEWENSES PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM. DECAS CXXIV.

1231. **Ruyschia phylladenia** *Sandwith* [Marcgraviaceae]; a *R. clusiifolia* Jacq. atque *R. platyadenia* Gilg nectariis e medio vel paullo supra medium pedicellorum exsertis, a *R. sphaeradenia* Delp. nectariis majoribus spathulatis fere planis foliaceis differt.

Frutex (scandens?) 3-4 m. altus; rami florigeri 3-5 mm. diametro. *Folia* obovata vel obovato-oblonga, apice rotundata emarginata, basi in petiolum 2-3 mm. longum attenuata, 4-7.5 cm. longa, 1.5-3 cm. lata, coriacea, utrinque costa excepta omnino enervia aut nervis subtus nonnunquam fere visibilibus. *Racemi* elongati, 10-15 cm. longi, multiflori; rhachis valde corrugato-sulcata, 2-3 mm. diametro; pedicelli conspicue adscendentes nec horizontales, 5-7 mm. longi, ut cetera inflorescentia glabri. *Nectaria* e medio vel paullo supra medium pedicellorum exorientia; petiolus quam in ceteris speciebus ita laxius pedicello coalitus ut lineae decurrentes facile cerni possint; lamina adscendens, coriacea, applanata, foliacea atque vix gibbosa, spathulata, apice nonnunquam acutata, 4-5 mm. longa, 1.8-2.5 mm. lata. *Prophylla* ovata, ad 2.5 mm. longa, 2 mm. lata. *Sepala* semiorbicularia, ad 2 mm. longa, 2.5-3 mm. lata. *Petala* atque stamina delapsa. *Fructus* subglobosus, circiter 2 mm. longus, ad 2.5 mm. diametro, in stylum haud 1 mm. longum abiens.

COSTA RICA. Border of wood, Las Concavas, Aug. (1919?), comm. 1920, C. H. Lankester K. 93. Described as an 'arbolito sarmatoso.'

This extends the range, already remarkably wide and interrupted, of a curiously small genus.

1232. **Impatiens Barnesii** C. E. C. Fischer [Geraniaceae]; *I. orchiioidi* Bedd. affinis, foliis basi rotundatis haud cordatis, labello oblato, alis haud caudatis differt.

Herba acaulis, pendula, delicatissima; bulbus parvus globosus. *Folia* 1-2, membranacea, ovata vel elliptico-ovata, acuta vel subacuta, basi rotundata, plus minus inaequilateralia, marginibus remote denticulatis, 2-8 cm. longa, 1.3-3.6 cm. lata, nervis primariis utrinque 3, adscendentibus, supra sparse pilosa, subtus glabra; petioli graciles, glabri, 2-4 cm. longi. *Scapus* gracilis, glaber, 4-5 cm. longus, pauciflorus; bracteae lanceolatae vel ovatae, subacutae; pedicelli graciles, c. 1.5 cm. longi. *Flores* 2-2.5 cm.

longi. *Sepala* ovato-falcata, 5 mm. longa. *Vexillum* ovato-oblongum vel suborbiculare, rotundatum, 1-1.2 cm. longum, basi brevissime accatum. *Petala* delicatissima. *Alae* 2-lobatae, 1.75-2.3 cm. longae; lobus inferior oblongus, obtusus, c. 7 mm. longus; lobus distalis oblongo-lanceolatus, obtusus vel parum emarginatus, c. 1.5 cm. longus. *Labellum* oblatum, 7-9 mm. longum, 1-1.25 cm. latum. *Capsula* ellipsoidea, acuta, 8 mm. longa.

INDIA. Nilgiri Hills, Kundahs, about 8000 ft., Sept., *E. Barnes* B 30 (type in Herb. Kew.), B 31. "On moss-covered tree trunks with its leaves and flowers hanging down . . . in deep shade in very wet sholas overlooking Malabar . . . I have also seen the leaves and capsules on trees near the top of Mukurti. . . . In the few specimens I saw the tip of the wing-petals were curled to form a tube. . . . The flowers are cream-coloured or almost white, very thin and fragile and soon drop." (*E. Barnes* in epistola.)

1233. *Impatiens laticornis* C. E. C. Fischer [Geraniaceae]; inter *I. clavicornu* Turcz. et *I. modestam* Wight, ab illa foliis apice angustatis supra pilosis, ab hac calcari incurvato valde lato, ab utraque lobis alarum inferioribus minoribus differt.

Herba erecta, acaulis, stolonifera; bulbus parvus, globosus. *Folia* 1-2, subcarnosa, suborbicularia vel ovata, obtusa, basi cordata, 1.5-4 cm. longa, 1.2-2.5 cm. lata, marginibus apiculato-crenatis, basi plus minus 5-costata, nervis primariis utrinque 1-2, adscendentibus, subtus manifestioribus, supra pilosa, pilis subulatis multicellulatis, subtus glabra vel fere glabra, pagina inferiore petiolisque saepe purpurascens; petioli glabri, laminam subaequantes. *Scapi* solitarii vel bini, glabri, saepius rubri, 6-17 cm. longi, 2-10-flori; bracteae oblongae vel ovato-oblongae, obtusae, concavae, semiamplexicaules, 3-6 mm. longae; pedicelli 1-1.7 cm. longi. *Flores* albi, rubro- vel aurantiaco-pilosi, c. 2 cm. longi. *Sepala* ovato-falcata late ovata vel subcordata, obtusa, viridia, 5 mm. longa. *Vexillum* suborbiculare, obtusum, concavum, 6-8 mm. longum, in calcar curvatum bulboso-clavatum fauce 2 mm. diam. apice 4 mm. diam. productum. *Alae* 3-lobatae, basin versus pilosae; lobus inferior ovato-oblongus, rotundatus, 4-5 mm. longus, intra labello incurvatus; lobus medius suborbicularis, 8-9 mm. diam.; lobus distalis oblongus, obtusus, 9-13 mm. longus. *Capsula* ellipsoidea (matura non visa).

INDIA. Nilgiri Hills, Kundahs at about 8000 ft., Sept., *E. Barnes* B 41 (type in Kew. Herb.), B 40, B 42. "Common in the region of Hill 8510 on wet rocks and on tree trunks and in other shady places exposed to the rain and mists from Malabar. . . . A magenta-coloured form (B42A) also occurs." (*E. Barnes* in epistola.)

1234. *Banara regia* *Sandwith* [Samydaceae-Banareae]; nulli speciei evidenter affinis, inflorescentia maxima, foliis maximis basi inaequilateralibus profunde cordatis primo visu distinguenda.

Arbor "60-pedalis, speciosa, recta, ramulis longissimis pendulis distiche foliosis" (*Spruce*); ramuli summi siccitate obscure purpurei, glabri, angulati atque profunde sulcati, ad 7 mm. diametro. *Folia* (unum tantum e ramulo florifero lectum superest) maxima, elliptico-oblonga, apice obtusa sed costa centrali in mucronem brevem 1 mm. longum excurrente, basi inaequilateraliter profunde obliquiter auriculato-cordata, lobis rotundatis majore (superiore?) 3 cm. longo 5.5 cm. lato minore 0.7 cm. longo 1.5 cm. lato, 38 cm. longa, 12 cm. lata, tenuiter coriacea, utrinque subnitida, nervis venulisque utrinque praecipue subtus satis prominentibus, nervis arcuatis latere majore 22 minore 16, supra glabra, subtus costa nervisque necnon facie minute pilosula, conspicue crenato-dentata, dentibus glanduligeris a se 0.5 1.5 cm. distantibus; petiolus indumento costae praeditus, 1.3 cm. longus, ut videtur eglandulosus. *Paniculae* "terminales, saepe maximae, 4-pedales" (*Spruce*) identidem compositae, apice pyramidales ad 24 cm. latae; rami ramulique glabri, siccitate obscure purpurei, angulati atque sulcati, versus apices crescentim abbreviati; ramuli ultimi inferiores cymis trifloris ceteri pedicellis solitariis praediti; pedicelli glabri, ad 7 mm. longi, supra basim articulati, eundem colorem praebentes. *Flores* "flavi, odorati" (*Spruce*), trimeri vel tetrameri, expansi circiter 1 cm. diametro. *Sepala* ovata, acuta, 3 5 mm. longa, ad 3.5 mm. lata, extra siccitate obscure purpurea marginibus fulvis exceptis, praesertim prope apicem marginesque plus minusve conspicue pubescentia, intus dimidio superiore dense griseo-tomentella. *Petala* late ovato-oblonga, obtusa, ad 6 mm. longa, ad 5 mm. lata, igitur sepalis longiora, flore expanso cum sepalis reflexa, extra marginibus exceptis dense griseo-tomentella, intus glabrescentia sed hic illic conspicue pilosula vel tomentella. *Stamina* petala fere aequantia vel haud multum excedentia, filamentis glabris liberis disco glabro insidentibus. *Ovarium* ovoideo-ellipsoideum, glabrum, 4 5 mm. longum, 2.5-3.5 mm. diametro, in stylum glabrum 2 mm. longum attenuatum; placentae 6.

ECUADOR. At the foot of Mt. Chimborazo, 900-1200 m., Aug. 1860, *Spruce* 6160. "The leaves on the flowering branches are mostly mutilated, and some fine ones, 2 ft. long, I took from a sterile branch seem unfortunately to have been lost."

Readers of *Spruce's* "Notes of a Botanist on the Amazon and Andes," ed. Wallace, vol. ii. chap. xxi, will remember that in August, 1860, he was occupied at El Limon, on the western side of Chimborazo, in the important task of obtaining seeds and young plants of *Cinchona succirubra* for the Indian Government. A sketch of the vegetation of the Red Bark forests of Chimborazo is given in the same chapter, and the species here described appears on p. 281, being listed under Tiliaceae. It is noted as a very handsome tree, abundant and ornamental about the middle region of the Red Bark. On p. 276 we are told that *Spruce* was too busy with his official work to be able to collect many specimens of plants which were not of

economic value; in fact, he "collected very few (often unique) specimens of each plant." Judging from the material of this fine species in Herb. Hook. in the Kew Herbarium, it may be assumed that little or none was available for further distribution. It must be borne in mind that these later numbers of Spruce were never properly named and listed by Benthams; consequently, other undescribed novelties from this area may be expected among them.

1235. **Strychnos silvicola** A. W. Hill [Loganiaceae]; *S. barbatae* A. W. Hill affinis, sed foliis ovato-lanceolatis acutis superne vernicosis corollae lobis glabris praecipue differt.

Frutex scandens, ramis glabris, spinis binis teretibus circinatis 2-6 cm. longis. *Folia* lanceolato-ovata vel elliptico-lanceolata, acuta, triplinervia, basi rotundata vel paulo angustata, 8-14 cm. longa, 4.5-7 cm. lata, glabra, superne vernicosa; petioli 6-7 mm. longi, glabri. *Inflorescentiae* axillares, paniculatae, 4-8 cm. longae; pedunculi et pedicelli minute tomentosi. *Calycis* segmenta late ovata, subacuta, circiter 1 mm. longa et lata, marginibus ciliatis. *Corolla* 5 mm. longa, alba, lobis 2-2.25 mm. longis ovato-lanceolatis reflexis acutis, intus fauce et tubo superne cingulo pilorum instructa. *Antherae* 1 mm. longae, ovoideae, basi paulo barbatae. *Ovarium* ovoideum, cum stylo 3.5-4 mm. longum, pilosulum. *Fructus* globosus, lignosus, 1.5-1.8 cm. diametro. *Semina* 3-4, discoidea, 1.5 cm. diametro, compressa, circiter 2.5 mm. crassa.

SIAM. Kaw Tao, Surat, 10 m., in evergreen forest, *Kerr* 11238 (type); Kaw Pa-ngan, Surat, *Put* 1254; Kaw Samui, Surat, *Put* 1306; Tung Wa, Surat, 10 m., edge of evergreen forest, *Kerr* 13903; Kaw Tao, Surat, below 5 m., in evergreen forest, *Kerr* 12990; Kaw Chang Ranawng, climbing in evergreen forest bordering beach, *Kerr* 16554; Tanjong Po, Satul, climbing over trees by beach, *Kerr* 14232; Kao Talu Ranawng, 50 m. (local name Tao Plawng), in evergreen forest, *Kerr* 11838.

1236. **Jacquemontia ciliata** Sandwith [Convolvulaceae-Convolvuleae]; *J. pentanthae* (Jacq.) G. Don affinis, sepalis subaequalibus obtusis ciliatis distinguitur.—*J. menispermoides* Standley in Contr. U.S. Nat. Herb. xxvii. 313 (1928)?

Herba volubilis; caules pilosuli, pilis debilibus plus minusve adpressis, partibus novellis flavicantibus conspicuis, ad 2 mm. diametro; internodia vulgo 3-6 cm. longa. *Folia* late triangulari-ovata ad ovato-lanceolata, apice sensim conspicue acuminata, basi rotundata cordata vel fere truncata, adulta 3.5-7 cm. longa, 2-5 cm. lata, marginibus saepe subsinuatis, utrinque pilosa sed senectute glabrescentia pilis adpressis plus minusve raris conspersa, subtus quam supra pallidiora nervis venulisque satis reticulatis; petiolus pilosulus, 1-2.5 cm. longus. *Inflorescentia* axillaris, longipedunculata, multiflora, umbelliformis, cymis contractis densis, adulta 1.5-3.5 cm. diametro; pedunculus communis indumento caulium

saepius densiore atque magis adpresso, folium subtendens saepius longe excedens, 4-11 cm. longus; bractee setaceae, ad 2 mm. longae; pedicelli 3-5 mm. longi, sub fructu glabrescentes. *Sepala* scariosa, subaequalia, duo exteriora interioribus paullo longiora, oblonga, obtusa, rotundata, secus totos margines conspicue ciliata, ceterum glabra, 4-5.5 mm. longa, circiter 2 mm. lata, circum fructum latiora. *Corolla* 1.2-1.8 cm. longa, pallide caerulea, lobis acutis mucronatis. *Stamina* circiter 2 mm. supra basim corollae inserta; filamenta longiora 5.5 mm., breviora 4.5 mm. longa. *Ovarium* ovoideo-subglobosum, glabrum, ad 1.5 mm. longum, ad 1.2 mm. diametro; stylus circiter 1 cm. longus, stigmatibus 1.5 mm. longis. *Fructus* globosus, 4-valvis, ad 5 mm. longus atque diametro, sepalis auctis apice recurvatis cinctus; semina ad 2.5 mm. longa.

TRINIDAD. In open places on the outskirts of Irois Forest, Jan. 1928, *Broadway* 6718 (type); *ibid.*, Williams in *Trin. Herb.* 11923.

COSTA RICA. Las Vueltas, Tucurrique, 635 m., Nov. 1898, *Tonduz* 12821. Presumably it occurs on the coast of Northern South America.

This agrees with no other species described (e.g. in *Flora Brasiliensis*) as having obtuse and ciliate sepals, since the outer sepals are the longer, while the general facies and indumentum are those of *J. pentantha*. It seems extremely probable that the plant recorded from Panama by Standley as *J. menispermoides* Choisy is this species, the true *menispermoides* being peculiar to the neighbourhood of Rio de Janeiro.

1237. ***Vitex calothyrsa*** *Sandwith* [Verbenaceae-Viticeae]; sect. *Agnus-Castus*, § *Terminales* pertinens, *V. Sprucei* Briq. affinis, foliis 3-foliolatis, foliolis basi semper rotundatis, dentibus calycinis brevioribus differt.—*V. pacimonensis* Spruce, ms. in sched., ined.

Arbor ad 18 m. alta, ramis florigeris glabris vel minute puberulis, lenticellatis, ad 7 mm. diametro. *Folia* 3-foliolata; petiolus minute puberulus, nigrescens, supra applanatus, subtus convexus, 2.5-7 cm. longus, ad 2 mm. latus; petioluli similes sed supra saepius profunde canaliculati, laterales 5-10 mm. longi, terminales nonnunquam longiores ad 12 mm. longi; foliola ovato-lanceolata vel oblongo-lanceolata ad lanceolata, apice conspicue attenuata acuminata, nisi in foliis male evolutis late elliptica atque rotundata emarginata, basi semper rotundata, 6-16 cm. longa, 3-7 cm. lata, nitida, coriacea, oculo nudo utrinque glabra sed sub lente subtus minute sparse pubescentia, nervis supra impressis, subtus prominentibus rete venularum non valde conspicuo, nervis primariis in utroque latere costae 9-12 arcuatis prope marginem anastomosantibus. *Inflorescentia* speciosa, thyrsoido-paniculata, pyramidata, illam specierum quarundam *Verbasci* revocans, terminalis, nonnunquam etiam ex axillis summis exoriens, ad 30 cm. longa atque 15 cm. lata; rami plus minusve dense pubescentes, arcuato-adscendentes, inferiores

longissimi, tum gradatim decrescentes; cymae ipsae in ramis plerumque per paria inferne 2-4.5 cm. distantia oppositae, trichotomae, compositae, congestim multiflorae, dense pubescentes, cum pedunculo brevi 1-2.5 cm. longae, ad 1.5 cm. diametro; bractee bracteolaeque ovatae, dense pubescentes, illae ad 3 mm., hae ad 1 mm. longae; pedicelli dense pubescentes, 1-5 mm. longi. *Calyx* campanulatus, extra plus minusve dense pubescens atque sub pubescentia nigrescens, intus nigrescens fere glaber, 1.5-2.5 mm. longus, 2-4 mm. latus; dentes breves, saepe inconspicui, late triangulares, 0.5-1 mm. longi, ad 1.5 mm. lati. *Corolla* caerulea, ante expansionem loborum 7-9 mm. longa, tubo sensim ad 3 mm. latitudinem ampliato, extra passim densissime pubescens triente tubi inferiore glabrescente nigrescente excepto, intus tubo fere glabra vel sparse pilosa, fauce hic illic pilosa, lobis intus minute velutino-tomentella; lobi minores circiter 4 mm. longi, 3.5 mm. lati, lobus anterior intimus major ad 7 mm. longus, 5 mm. latus. *Stamina* vix 2 mm. supra basim tubi affixa, longiora 7 mm. longa, breviora 6 mm. longa; filamenta prope insertionem dense pubescentia, ceterum parce hispida vel glabrescentia. *Ovarium* subglobosum, ad 1.5 mm. longum atque diametro, dimidio superiore densissime pubescens, inferiore nigrescens fere glabrum; stylus hispidus ad 8 mm. longus, lobis subulatis glabris ad 0.5 mm. longis. *Fructus* drupaceus, obovoideo-globosus, ad 1.3 cm. longus, ad 1.2 cm. diametro, calyce aucto obscure lobato 5-6 mm. diametro insidens.

VENEZUELA. Banks of the Rio Pacimoni, Feb. 1854, *Spruce* 3356 (type). "Arbor patula, 30-pedalis; flores caerulei, odorati."

BRAZIL. Rio Negro; Rio Padawiri (Padauiry), March 1839, *Robert Schomburgk* 1009 (1st collection). "A tree, 50 to 60 ft. high. Leaves dark lucid green; bark brown, rough. Calyx greyish. Petals bright blue; filaments white; anthers blue." Most of the leaflets of this collection are broader than those of *Spruce's* plant, but it is obviously conspecific, and the description is compiled from both.

The source of the Pacimoni is about 100 miles to the west of the upper part of the Padauiry, but from *Robert Schomburgk's* account of his travels, it is evident that he collected his specimens near the confluence of the Padauiry with the Rio Negro on the left bank of the latter river. These, like many other sheets of *Robert Schomburgk's* first collection from the Rio Negro and Rio Branco, and a few from Venezuela, are wrongly labelled "British Guiana. R. H. Schomburgk (1st coll.)." *Bentham* omitted to copy out *Robert Schomburgk's* manuscript notes, which are fortunately preserved in the library of the Kew Herbarium, a fact which should be noted by botanists working on the Guiana flora, who may be in doubt as to the correct locality—whether British Guiana, Venezuela or Brazil—of any particular number of this collection.

1238. ***Pandanus (Vinsonia) Basedowii*** *C. H. Wright* [*Pandanaceae*]; affinis *P. Hornei* Balf. f., a qua foliis angustioribus drupisque paucioribus differt.

PLATE VI



Photo: Dr. H. Basedow.

Pandanus (Vinsonia) Basedowii.

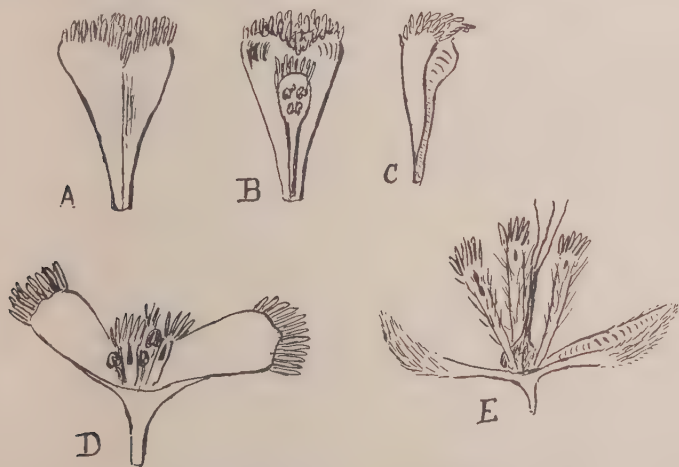
[To face page 158.

Caulis 4.5 m. altus; rami fere horizontales, 2-3 m. longus, 2.5 cm. diam. *Folia* lineari-acuminata, circiter 3 dm. longa, 1-1.5 cm. lata, basi breviter lateque amplexicaulia, spinis brunneis 1 mm. longis 6-10 mm. distantibus ad margines carinamque instructa. *Syncarpia* solitaria; drupae 8-10, 7 cm. longae, 4.5 cm. diam., 2-loculares, obtuse 4-5-angulatae, pallide brunneae; mesocarpium 12-18 mm. crassum, fibrosum; endocarpium tenue. *Semina* oblonga, concavo-convexa, 2 cm. longa, 1 cm. lata, 0.5 cm. crassa.

AUSTRALIA. High tablelands of Arnhem Land, c. 310 m. alt., Dr. Herbert Basedow.

While most species of *Pandani* inhabit seashores, this one is remarkable for growing on dry, rocky, barren surfaces in the interior of Arnhem Land at an altitude of about 1000 ft. Its habitat is shown in some photographs received from Dr. Basedow (see Plate VI.). *P. monticola* F. v. Muell. grows in similar situations in Queensland, but belongs to the *Acrostigma* section. A ripe drupe with its fibrous mesocarp and thin sclerenchymatous endocarp weighs less than $\frac{1}{2}$ oz. and could easily be dispersed by the wind.

1239. **Eriocaulon ensiforme** C. E. C. Fischer [Eriocaulaceae]; *E. sexangulare* Linn. affinis, pedunculo solitario, capitulis majoribus, sepalis exalatis differt.



Eriocaulon ensiforme C. E. C. Fischer. A. Floral bract, dorsal aspect $\times 5$. B. Floral bract, ventral aspect with σ flower $\times 5$. C. Floral bract, lateral aspect $\times 5$. D. σ flower $\times 7$. E. φ flower $\times 7$.

Caulis brevis, sericeo-lanuginosus. *Folia* erecta, equitantia, ensiformia, acuta, 14-26 cm. longa, 1-1.5 cm. lata, infra parce pilosa et minute papillosa, c. 20-nervia. *Pedunculus* solitarius, haud tortus, c. 40 cm. longus, glaber, valde c. 10-costata; vagina pedunculum arte amplexens, folia circiter adaequans, oblique longe fissa, acuta, externe parce pilosa. *Capitulum* depressoglobosum,

1.3 cm. diametro; receptaculum pilosum; bracteae involucales obovatae, obtusae, 3 mm. longae, glabrae, exteriores pallido-brunneae, interiores fusco-brunneae; bracteae flores stipantes patentibus regulariter imbricatae, rhomboideo- vel obovato-cuneatae, acutae, basin versus angustatae, fuscae, parte superiore inflexa et dorso albo-pilosa, parte inferiore parum carinata, 5 mm. longae. *Flos* ♂ stipitatus, 3 mm. longus; sepala 2, fere libera obovata, alterum latius, truncata, abrupte apiculata, fusca, apicem versus dense albo-pilosa; corolla brevis, cylindrica, lobis 3 ligulatis, uno longiore, apice albo-pilosis et glandulis ensiformibus nigris instructis; stamina 6, antheris nigris. *Flos* ♀ breviter stipitatus, 4 mm. longus; sepala 2, libera, navicularia, acuta, parte superiore externe dense albo-sericea, inferiore angustata, glabra; petala 3, linearia, longe sericeo-hirsuta, apice albo-pilosa, glandulo nigro instructa; ovarium sessile, stigmatibus 3, petala superantibus.

INDIA. Tinneveli District; near Naterikal, March. Only one plant seen (type in Herb. Kew), *Madras Govt. Botanist* 14497.

1240. *Eriocaulon Gamblei* C. E. C. Fischer [Eriocaulaceae]; *E. Thwaitesii* Koern. affine, sed multo minus, pedunculis apice tumefactis, capitulis minoribus, bracteis involucribus fusco-viridibus differt.



Eriocaulon Gamblei C. E. C. Fischer. A. Floral bract $\times 9$. B. ♂ flower $\times 14$. C. ♀ flower $\times 11$. D. ♀, petal $\times 20$.

Herba minima. *Caulis* perbrevis. *Folia* linearia, acuta, usque 1.3 cm. longa, 0.5 mm. lata, 1-venosa. *Pedunculi* solitarii vel pauci, 1.5-4 cm. longi, glabri, 2-4-costati, haud vel parum torti, sub involucri hemisphaerico-tumefacti; vagina superne laxa, folia circiter adaequans, oblique fissa, acuta, glabra. *Capitulum* pauciflorum, obcuneatum, 2 mm. longum et latum; receptaculum breviter conicum, pilosum; bracteae involucales obovato-oblongae, obtusae vel apiculatae, fusco-virides, glabrae, 2 mm. longae; bracteae flores stipantes anguste obovatae, concavae, obtusae vel subacutae, fusco-virides, 2 mm. longae, apice breviter puberulae. *Flos* ♂ 2 mm. longus, pedicello longo, gracili; sepala 2, anguste obovato-oblonga, fusca, apice breviter albo-pilosa; corolla cylindrica, ore expansa, lobis perbrevibus, apice glandulo nigro instructis et breviter albo-pilosis; stamina 6, antheris nigris. *Flos* ♀ breviter stipitatus, 2 mm. longus; sepala 2, libera, navicularia, interdum

carinata, obtusa, fusca, apice dorso breviter albo-pilosa ; petala 3, capillaria, sepalis duplo breviora, eglandulosa, pilis longis apice dense cristata ; ovarium breviter stipitatum, stylo brevi, stigmatibus 3, longis. *Semina* subgloboso-ovata, rubro-brunnea, leviter transverse reticulata, nonnunquam papillis albis longitudinaliter lineata.

S. INDIA. Naduvattam, Nilgiri Hills, 6000 ft., Oct., J. S. Gamble 14881 (type in Herb. Kew.).

XVII.—CONTRIBUTIONS TO THE FLORA OF SIAM.* Additamentum XXVII.

Pygeum Kingianum Craib [Rosaceae-Pruneae] ; a *P. lanceolato* Hook. f. foliis basi latioribus, sepalis angustioribus magis numerosis, ovario haud glabro recedit, a *P. persimile* Kurz ovario pilis haud oblecto distinguendum.

Frutex circa 4 m. altus (ex *Kerr*) ; ramuli graciles, primo fulvo-pilosi, mox puberuli, brunneo-corticati, demum fusco-corticati, glabri, lenticellis parvis. *Folia* lanceolata, oblongo-elliptica, vel subovata, apice obtuse acuminata, basi haud rarius inaequilateralia, cuneata rotundatave, 5.5–11 cm. longa, 3–5.5 cm. lata, chartacea, sicco plus minusve brunnescentia, supra glabra, subtus ad costam nervosque laterales parce pubescentia, basem versus glandulis duabus instructa, paucis aliis secundariis parvis additis, costa supra impressa subtus prominente, nervis lateralibus utrinque 6 bene intra marginem anastomosantibus supra vix conspicuis subtus prominulis, integra, petiolo 7–8 mm. longo primo parce piloso cito glabro supra canaliculato suffulta ; stipulae fugaces, lineares, circa 5 mm. longae. *Racemi* axillares, saepissime e ramulis defoliatis orti, pedunculo communi brevi incluso paulo ultra 1 cm. longi, partibus omnibus breviter fulvo-pilosi ; bracteae subovatae, obtuse subacuminatae, circa 2 mm. longae ; pedicelli 1 mm. longi. *Receptaculum* 2 mm. longum, apice circa 3 mm. diametro, intra glabrum. *Sepala* 10, obtuse subdeltoidea, 1 mm. longa. *Petala* haud visa. *Filamenta* glabra, 1.5 mm. longa, antheris parvis. *Ovarium* pilis sat longis sericeis inferne instructum ; stylus 2.5 mm. longus, glaber, sat robustus ; ovula 2, pendula.

Pang-nga, Kao Bangto, 100 m., evergreen forest, *Kerr* 17167.

Pyrus fragrans *Geddes* [Rosaceae-Pomeae] ; a *P. cuspidata* Bertol. foliis breviter acuminatis, nervis minus numerosis adscendentibus, inflorescentia laxa glabra et pauciflora differt.

Arbor circa 10 m. alta (ex *Kerr*) ; ramuli brunnei, striati, glabri. *Folia* ovato-oblonga, apice breve et obtuse acuminata, basi late cuneata vel rotundata, 4–10 cm. longa, 2.8–7 cm. lata, chartacea, mox subcoriacea, supra brunnea, subnitentia, glabra, subtus pallidiora, glabra, nervis lateralibus utrinque 8–11 pagina superiore conspicuis inferiore prominentibus, margine crenulata, petiolo

*Continued from *K.B.*, 1929, p. 119.

1.5–3.5 cm. longo glabro suffulta. *Cymae* terminales, usque ad 5 cm. longae; pedicelli 2–4 mm. longi, filiformi-bracteolati, glabri. *Calycis* lobi 5, ovato-elliptici, apice obtusi, 3 mm. longi, 1.8 mm. lati, glabri. *Petala* 5, alba (ex *Dr. Smith*), rotundata, basi cuneata, 4–5 mm. diametro, venata, extra glabra, intra puberula. *Stamina* permulta, biseriata. *Ovarium* 2-loculare, per loculum biovulatum, glabrum; styli duo, 5 mm. longi, basi ad 2.5 mm. inter se connati, glabri. *Fructus* vix maturus, pyriformis, 1 cm. longus, subconspicue lenticellatus.

Nakawn Sritamarat, Kao Luang, 1500–1750 m., evergreen forest, *Kerr* 15513 (*fruit*), *Dr. Eryl Smith* 730 (*flower*).

***Terminalia densiflora* Craib** [Combretaceae]; a *T. alata* Roth, cui maxime affinis videtur, indumento multo densiore, spicis rigidis densifloris recedit.

Arbor circa 10 m. alta (ex *Kerr*); ramuli iuventute tomento denso cinnamomeo, pallide cinnamomeo, vel interdum subferrugineo obtecti, tomento diutius persistente, subteretes, ad 4 mm. diametro. *Folia* opposita vel subopposita, oblonga vel elliptica, apice rotundata vel saepius truncata et late retusa, basi rotundata, ad 8.5 cm. longa et 5.5 cm. lata, sat rigida, subtus pallidiora, supra sparse sericea, ad costam dense adpresse pubescentia, subtus tomentosa, pagina inferiore paulo supra basem ad costam glandulis duabus subglobosis circa 1.5 mm. diametro plus minusve tomentosis sessilibus instructa, nervis lateralibus utrinque 10–11 sat patulis intra marginem curvatis supra conspicuis subtus prominentibus, nervis transversis subtus fere subconspicuis, margine integra, tomentoso-ciliata, petiolo 4–5 mm. longo indumento ei ramulorum simili oblecto eglanduloso suffulta. *Spicae* et axillares et in paniculam efoliatam terminalem circa 8 cm. longam dispositae, pedunculo communi 5–10 mm. longo incluso 3.5–7 cm. longae, densiflorae, et pedunculo et rhachi indumento ei ramulorum simili oblectis; bractee circa 1.5 mm. longae, sub anthesin deciduae; flores sessiles. *Receptaculum* densius tomentosum, subteres, vix 1 mm. longum, 1.25 mm. diametro. *Calyx* dorso tomentosus, intra ad lobos sparse longius pilosus, basi pilis erectis longis dense pilosus; tubus 1 mm. longus; lobi 5, deltoidei, subacuti, paululo ultra 1 mm. longi et lati. *Stamina* 10, filamentis pallidis glabris superne angustatis 3.5–3.75 mm. longis, antheris versatilibus breviter obtuse apiculatis, loculis basi inter se liberis. *Stylus* calycem fere 2 mm. superans; ovula 2, pendula.

Nakawn Tai, 200 m., deciduous forest, *Kerr* 5845.

***Combretum alatum* Craib** [Combretaceae]; ab affini *C. quadrato* Craib ramulis alatis, petiolis conspicue brevioribus recedit.

Frutex volubilis (ex *Kerr*); ramuli circa 3 mm. diametro, primo dense squamosi, quadrangulares, angulis anguste sed conspicue alati, pallide brunneo-corticati. *Folia* opposita vel subopposita, oblonga vel elliptica, apice obtuse acuminata, basi rotundata vel late cuneata,

6.5-10 cm. longa, 3.5 cm. lata, rigide chartacea, pagina utraque dense parvi-squamosa, nervis lateralibus utrinque circa 8 supra plus minusve conspicuis interdum impressis subtus subprominentibus, nervulis supra obscuris subtus paucis subconspicuis, integra, petiolo usque ad 5 mm. longo dense squamoso supra late canaliculato suffulta. *Spicae* in paniculas axillares et terminales foliatis dispositae, pedunculo communi rhachi florifera paulo longiore incluso 2.5-3.5 cm. longae, dense squamosae praeterea parce puberulae; bracteae ad pedunculorum bases foliaceae, inferiores ad 3 cm. longae, supremae circa 1 cm. longae; floris bractea parva, cito decidua; flores virides (ex *Kerr*). *Receptaculum* in tubum 3.5 mm. longum apice 2.5 mm. diametro extra squamosum intra apice annulo denso pilorum rigidorum et erectorum et deflexorum instructum supra ovarium productum. *Calycis* tubus brevis, lobi 4, deltoidei, obtusi, circa 1 mm. longi et lati. *Petala* 4, plus minusve rotundata, circa 0.75 mm. diametro, breviter sed distincte unguiculata. *Stamina* 8, filamentis glabris ad 2.5 mm. longis, antheris parvis oblongis brevissime apiculatis, loculis basi inter se liberis. *Stylus* 6 mm. longus, glaber; ovarium 2.5 mm. longum, obtuse quadrangulum, dense squamosum, intra basi pilis longis erectis ornatum, ovulis 4 pendulis.

Chiengmai, Mè Rim, 800 m., evergreen forest, *Kerr* 6440.

Combretum foliatum *Craib* [Combretaceae]; a *C. squamoso* Roxb. bracteis foliaceis, fructu faciebus processibus lineari-lanceolatis vel deltoideis instructo recedit.

Frutex volubilis (ex *Kerr*); ramuli primo angulati, dense brunneo-squamosi, mox teretes, squamis paucis persistentibus. *Folia* opposita vel subopposita, subelliptica, elliptico-ovata, vel elliptico-obovata, apice acuminata vel cuspidato-acuminata, basi rotundata vel late cuneata, 8-13 cm. longa, 5-8 cm. lata, subcoriaceo-chartacea, pagina utraque squamis parvis sat copiose instructa, nervis lateralibus utrinque 6-8 supra conspicuis subtus prominentibus intra marginem anastomosantibus, nervis transversis paucis supra subconspicuis subtus vix conspicuis, integra, petiolo 10-13 mm. longo dense squamoso supra conspicue canaliculato suffulta. *Spicae* in paniculam terminalem foliatam, foliis (vel bracteis foliaceis) superne gradatim minoribus inferioribus ad 6 cm. longis et 3 cm. latis petiolo 8 mm. longo suffultis supremis oblanceolatis 2 cm. longis 0.7 cm. latis petiolo 4 mm. longo suffultis, ad 30 cm. longam dispositae, pedunculo communi circa 1 cm. longo incluso ad 4.5 cm. longae, dense squamosae; bracteae saepissime deciduae, sublineares, acutae, 2 mm. longae. *Receptaculum* paululo post anthesin quadrangulum, dense squamosum. *Fructus* 4-alatus, alis inclusis suboblatus, 3 cm. longus, 3.5 cm. latus, faciebus processibus lineari-lanceolatis vel deltoideis squamis tectis instructus, alis stramineis horizontaliter striatis squamis tectis.

Pang-nga, Nop Pring, 20 m., climbing in scrub, *Kerr* 17239.

Combretum Winitii *Craib* [Combretaceae] ; ab affini *C. flagrocarpo* C. B. Clarke foliis multo maioribus, fructus alis pubescentibus recedit.

Frutex vagans ; ramuli primo sulcati, dense fulvo-pubescentes, mox teretes, tomentelli, 4-5 mm. diametro. *Folia* opposita vel ternata, oblonga, anguste elliptica, interdum subobovata, apice acute acuminata, basi cuneata vel rarius subrotundata, 15-23 cm. longa 7-12 cm. lata, rigide chartacea, sicco viridia, subtus parum pallidiora, pagina superiore ad costam nervosque laterales densius hirsuta, aliter sparse hirsuta, inferiore ad costam fulvo-tomentosa praeterea cum nervis lateralibus nervulisque pilis divaricatis sat rigidis instructa, nervis lateralibus utrinque 10-14 supra conspicuis subtus cum costa prominentibus intra marginem ipsam anastomosantibus, margine integra, ciliata, petiolo 12-17 mm. longo indumento ei ramulorum simili oblecto suffulta. *Racemi* simplices, apicem versus ramulorum positi, pedunculo communi circa 1 cm. longo incluso ad 8 cm. longi, indumento ei ramulorum simili oblecti, rhachi mox ad 2.5 mm. diametro ; pedicelli paulo post anthesin 3 mm. longi. *Receptaculum* paulo post anthesin quadrangulum, albo-hirsutum et faciebus processibus parce pubescentibus ad 1.5 mm. longis instructum. *Fructus* pedicello quadrangulo 4 mm. longo pubescente suffultus, 4-alatus, alis inclusis ambitu ellipticus, 2.6 cm. longus, 2.1 cm. latus, alis stramineis pubescentibus striatis, faciebus processibus persistentibus instructus.

Lampun, Mê Kaw, 270 m., near stream in deciduous forest, *Winit* 376. Rahêng, 270 m., deciduous forest not far from stream, *Winit* 181.

Quisqualis caudata *Craib* [Combretaceae] ; a *Q. densiflora* Wall. ex Miq. receptaculi tubo brevior, calycis lobis basi latioribus, petalis paulo latioribus apice rotundatis, antheris longioribus recedit.

Frutex volubilis (ex *Kerr*) ; ramuli primo dense breviter adpresse pubescentes, mox puberuli, cortice rubro-brunneo vel fusco-brunneo oblecti, substriati, teretes, lenticellis haud conspicuis. *Folia* saepissime oblonga vel oblongo-elliptica, apice subacute caudato-acuminata, basi rotundata, rarissime cuneato-rotundata, 6-11 cm. longa, 3-4.5 cm. lata, rigide chartacea, sicco subviridia vel plus minusve brunnescentia, supra ad costam puberula, aliter sparse pustulata, subtus ad nervorum axillas brunneo-pilosa, nervis lateralibus utrinque 6-7 marginem versus longius prorsus directis intra marginem anastomosantibus inter se sat distantibus supra conspicuis subtus subprominentibus, nervis transversis saepissime e costa et nervis lateralibus rectangulatim oreuntibus cum nervulis rete gracile subtus subprominulum supra interdum subconspicuum efficientibus, margine integra, petiolo 4-7 mm. longo puberulo fusco supra parum canaliculato suffulta. *Spicae* vel terminales tantum vel etiam saepe ex axillis supremis ortae, pedunculo communi brevi incluso circa 4 cm. longae, pedunculo cum rhachi dense breviter

adpresse pubescente; bracteae foliaceae, infimae ovato-oblongae, acute acuminatae, 18 mm. longae, 9 mm. latae, nervosae, puberulae, petiolo ovario dimidio brevior suffultae, aliis spicae apicem versus gradatim minoribus, supremis lanceolatis 12 mm. longis 3 mm. latis. *Receptaculum* supra ovarium ad 1.7 cm. tubuloso-productum, inferne oblique gibbosum, extra breviter adpresse pubescens et superne pilis paucis longiusculis instructum, intra glabrum. *Calycis* tubus brevis, segmenta 5, late deltoidea, longius acute acuminata, 2.75 mm. longa, basi 2 mm. lata, extra pilosa, intra adpresse pubescentia. *Petala* 5, punicea (ex *Kerr*), oblonga, apice rotundata, basi late cuneata, subunguiculata, 5 mm. longa, 2.5 mm. lata, utrinque sed extra densius adpresse puberula. *Stamina* 10, biseriata; filamenta glabra, circa 3 mm. longa; antherae versatiles, circa 1.25 mm. longae. *Stigma* antheras altiores attingens; ovarium angulatum, 3.5 mm. longum, sericeum; ovula pendula, 3 vel rarissime 2. *Fructus* ambitu anguste oblongus, 5-akutus, 2 cm. longus, alis inclusis 1.1 cm. diametro, glaber, alis circa 4 mm. latis brunneo-stramineis horizontaliter substriatis.

Ranawng, Kao Pawta Chongdong, 900 m., evergreen scrub, *Kerr* 16797.

***Eugenia cacuminis* Craib** [Myrtaceae-Myrteae]; inter species monticolas suffruticosas gregis *Jambosarum* foliis mediocribus saepissime oblongo-oblancoelatis acuminatis, cymis terminalibus, pedicellis (i.e. infra articulationem) haud evolutis, receptaculo brevi lato inferne in pseudopedicellum contracto cognoscenda.

Frutex circa 2 m. altus (ex *Kerr*), partibus omnibus glaber; ramuli primo subfusci, mox cortice brunneo-cinereo vel subcinereo obtecti, lenticellis haud conspicuis. *Folia* opposita, oblongo-oblancoelata vel elliptico-oblonga, apice obtuse acuminata, basi cuneata, 4-6 cm. longa, 1.5-2.8 cm. lata, coriacea, sicco supra fusco-viridia, subtus viridia, nervis lateralibus utrinque circa 12 rectis inter se parallelis paucis aliis tantum paulo minus conspicuis interiectis supra prominulis subtus conspicue prominulis, costa supra impressa subtus prominente, nervulis rete pagina utraque prominulum efficientibus, nervis intramarginalibus duobus, altero intra marginem ipsam altero robustiore circa 2 mm. intra marginem posito, margine cartilaginea, parum recurva, petiolo 3-4 mm. longo supra canaliculato suffulta. *Inflorescentia* terminalis, 1.5-2.5 cm. longa, simplex vel saepissime fere e basi furcata, bracteis deciduis, pedicellis (i.e. infra articulationem) haud evolutis. *Receptaculum* paulo post anthesin apice 7 mm. diametro, parte expansa late campanulatum, 5 mm. longum, basi in pseudopedicellum ad 3.5 mm. longum contractum. *Calyx* omnino deciduus.

Nakawn Sritamarat, Kao Luang, 1700 m., scrub, *Kerr* 15525.

***Eugenia furfuracea* Craib** [Myrtaceae-Myrteae]; ab *E. pallidula* Ridl., cui maxime affinis videtur, foliis apice rotundatis haud acuminatis recedit.

Ramuli iuventute compressi, glanduloso-furfuracei, cinnamomei, mox teretes, glabri, cortice cinereo vel cinnamomeo-cinereo obtecti, lenticellis haud conspicuis. *Folia* opposita vel subopposita, saepissime oblongo-obovata vel obovato-elliptica, apice rotundata, basi cuneata, interdum subacuminata, 7-12 cm. longa, 4-7.3 cm. lata, coriaceo-chartacea, sicco plus minusve brunnescentia vel saepius supra pallide plumbea, subtus pallide viridia, pagina utraque inconspicue parvi-punctata, nervis lateralibus utrinque circa 12 rectis supra conspicuis vel subconspicuis subtus subprominentibus, nervulis rete laxum subtus prominulum efficientibus, nervis intramarginalibus duobus, uno fere ad marginem subprominulo uno 2-3 mm. intra marginem subprominente, margine anguste cartilaginea, saepissime leviter recurva, petiolo 5-10 mm. longo suffulta. *Paniculae* et terminales et ex axillis foliorum superiorum ortae, laxae, pedunculo communi 2-7 cm. longo cum pedunculis partialibus 2-2.5 cm. longis et pedunculis ultimis ubi evolutis circa 1 cm. longis compresso cinnamomeo glanduloso-furfuraceo; alabastra turbinata; bracteae deciduae; pedicelli (i.e. infra articulationem) haud evoluti. *Receptaculum* in pseudopedicellum 2 mm. longum contractum, supra ovarium ad 2 mm. turbinato-productum, apice 5 mm. diametro, glanduloso-furfuraceum. *Flores* aperti haud visi. *Ovarium* 2-loculare.

Chumpawn, Bang Son, *Put* 1494.

Eugenia fuscescens Craib [Myrtaceae-Myrteae]; ab affini *E. alyxifolia* Ridl. foliis maioribus fere epunctatis, ab *E. subhorizontali* King, cui facie subsimilis, nervis lateralibus subtus minus prominulis, floribus conspicue minoribus recedit.

Arbor circa 10 m. alta (ex *Kerr*); ramuli fusi vel subfusi, iuventute plus minusve pustulati, compressi, saepissime angulati, circa 3 mm. diametro. *Folia* opposita vel subopposita, lanceolata vel oblongo-lanceolata, apice acute acuminata, basi cuneata sed saepe inaequalitalia, latere altero acuminata, altero cuneata, 8-14 cm. longa, 2-4.5 cm. lata, chartaceo-coriacea, sicco pagina superiore fusco-viridia, inferiore viridia, pagina utraque ad costam punctata et praesertim marginem versus inconspicue parvi-punctata, nervis lateralibus utrinque circa 20 rectis subpatulis supra saepissime subconspicuis subtus conspicuis parum impressis, nervulis subtus subconspicuis, nervo intramarginali saepissime circa 2 mm. a margine posito subtus parum impresso, margine anguste cartilaginea, parum recurva, petiolo 6-12 mm. longo supra argute canaliculato suffulta. *Panicula* terminalis, e basi ramosa, ad 5 cm. longa et basi 6 cm. diametro, ramulis oppositis, pedunculis partialibus infimis circa 8-10 mm. longis cum pedunculis ultimis usque ad 1.5 cm. longis brunneis vel fusco-brunneis; pedicelli infra articulationem haud evoluti vel brevissimi, apice bracteolis duabus parvis deciduis instructi. *Receptaculum* turbinatum, 4 mm. longum, apice 4 mm. diametro, inferne angustatum, pedicellum distinctum vix simulans, fuscum, parum glandulosum. *Calycis* segmenta decidua, circa

0.5 mm. longa. *Petala* ut videtur calyptratis decidua, glanduloso-punctata. *Stamina* circa 1 cm. longa; antherae parvae, breviter apiculatae. *Stylus* stamina circa 4 mm. superans; ovarium 2-loculare.

Ranawng, Kao Talu, 100 m., evergreen forest, *Kerr* 11786.

Eugenia globiflora Craib [Myrtaceae-Myrteae]; species quoad flores *E. Kurzii* Duthie similis sed foliorum nervis lateralibus magis approximatis et minus prominentibus distincta.

Arbor circa 15 m. alta (ex *Kerr*); ramuli teretes, glabri, cortice primo pallide brunneo mox cinereo obtecti, lenticellis haud conspicuis. *Folia* opposita, oblongo-lanceolata vel oblongo-oblancheolata, apice acuminata, basi cuneata, parum inaequilateralia, 7-15 cm. longa, 2.5-5.5 cm. lata, rigide chartacea, glabra, nervis lateralibus utrinque circa 10 aliis tantum paulo minus conspicuis additis supra conspicuis vel sicco subprominulis subtus prominulis bene intra marginem nervum intramarginalem formantibus, nervulis pagina utraque subprominulis, margine integra, recurva, anguste cartilaginea, petiolo 4-7 mm. longo supra canaliculato suffulta. *Inflorescentia* terminalis, laxa, ad 7 cm. longa, saepissime e basi ramosa, ramorum pedunculo communi usque ad 2 cm. longo, cymis ultimis e floribus tribus pedicellis 8-12 mm. longis suffultis vel cymarum terminalium subsessilibus constitutis, bracteis omnibus deciduis. *Receptaculum* 3 mm. longum, glabrum. *Calycis* segmenta 4, imbricata, 2 exteriora 4 mm. longa, 6 mm. lata, 2 interiora 5.5 mm. longa, 8 mm. lata, coriacea, glabra. *Petala* 4, imbricata, medio crassa, margine tenuia, ad 9 mm. longa et 8 mm. diametro. *Stamina* pluriseriata, filamentis ante anthesin inflexis. *Ovarium* 2-loculare, stylo circa 9 mm. longo.

Doi Pa Kao, 1500 m., evergreen by stream, *Kerr* 5388.

Eugenia irregularis Craib [Myrtaceae-Myrteae]; *E. microcalyci* Duthie habitu similis sed foliis maioribus vel saltem pro longitudine latioribus saepissime sicco viridibus recedit.

Arbor circa 15 m. alta (ex *Kerr*); ramuli iuventute subvirides, compressi, parum pustulati, mox rubro-brunnei, demum irregulariter cinerei, teretes, vix 4 mm. diametro, lenticellis haud conspicuis. *Folia* opposita vel subopposita, saepissime elliptica, apice breviter obtuse acuminata, basi cuneata vel subacuminata, 7-16 cm. longa, 4-8.5 cm. lata, rigide chartacea, sicco saepissime viridia, hic et illic plus minusve brunnescentia, pagina utraque sat copiose parvipunctata, nervis lateralibus utrinque circa 15 supra plus minusve conspicuis subtus prominulis, aliis tantum paulo minus conspicuis interiectis, intra marginem anastomosantibus et circa 3-5 mm. intra marginem nervum intramarginalem saepissime undulatum formantibus, apud marginem nervo intramarginali alio multo tenuiore evoluto, margine irregulariter conspicue revoluta, petiolo 0.5-1 cm. longo supra canaliculato suffulta. *Panicula* terminalis, a basi ramosa, usque ad 16 cm. longa et 15 cm. diametro, ramis oppositis vel suboppositis pedunculo ad 5.5 cm. longo incluso ad

10 cm. longis iterum ramosis cum ramulis sicco subviridibus compressis vel angulatis sparse pustulatis; flores ad quinque pedunculo saepissime circa 2 mm. longo suffulti, approximati, sessiles; alabastra ambitu suboblunga, 3 mm. longa, pustulata. *Calycis* lobi subdeltoidei, vix 0.5 mm. longi. *Corolla* ut videtur calyptratim decidua. *Ovarium* 2-loculare.

Takuapa, Kapong, 100 m. evergreen forest, *Kerr* 17128.

***Eugenia jugorum* Craib** [Myrtaceae-Myrteae]; ab *E. sublaeta* Craib foliis tenuioribus, receptaculo fere dimidio brevius recedit.

Arbustula circa 5 m. alta (ex *Kerr*), omnino glabra; ramuli primo parum compressi, rubro-brunneo-corticati, mox teretes, cortice cinereo vel subcinereo obtekti, lenticellis haud conspicuis. *Folia* saepissime lanceolata vel oblanceolata, rarius subelliptica, apice caudato-acuminata, rarius subcaudato-acuminata, basi cuneata, interdum inaequilateralia, 4-6 cm. longa, 1.5-2.5 cm. lata, rigide chartacea, sicco viridia, subtus pallidiora, pagina utraque subsparse punctata, nervis lateralibus utrinque numerosis inter se parallelis et 2.5-4 mm. distantibus subtus subprominulis supra conspicuis vel subconspicuis, nervo intramarginali conspicuo, nervulis rete subtus prominulum efficientibus, margine anguste cartilaginea, recurva, petiolo ad 1 cm. longo supra canaliculato suffulta. *Inflorescentia* e racemo terminali 7-floro efoliato constituta vel floribus inferioribus axillaribus; pedicelli infra articulationem 1-2.5 cm. longi, apice bracteolis duabus 3 mm. longis cito deciduis instructi. *Receptaculi* sub anthesin pars cylindrica vix 1 cm. longa, apice circa 3 mm. diametro, pars expansa circa 7 mm. longa, apice circa 12 mm. diametro. *Ovarium* 2-loculare.

Nakawn Sritamarat, Kao Luang, 1600-1700 m., evergreen forest, *Dr. Eryl Smith* 747 (*type*), *Kerr* 15533.

***Eugenia rhamphiphylla* Craib** [Myrtaceae-Myrteae]; ab affini *E. penangiana* Duthie foliis tenuioribus, receptaculi tubo supra ovarium expanso recedit.

Arbor circa 30 m. alta (ex *Kerr*), glabra; ramuli graciles, primo parum angulati, cito teretes, fusciscentes, cortice longitudinaliter fisso. *Folia* opposita vel subopposita, saepissime oblongo-oblanceolata, rarius oblongo-elliptica, elliptica, vel late lanceolata, apice longius obtuse acuminata, basi cuneata vel subacuminata, saepissime circa 7 cm. longa et 2.5 cm. lata, rigide chartacea, pagina utraque conspicue distanter punctata, sicco pallescentia, nervis lateralibus numerosis inter se parallelis supra fere obscuris subtus prominulis, nervo intramarginali intra marginem ipsam conspicuo, nervulis nervis lateralibus plus minusve parallelis subtus subprominulis, margine cartilaginea, petiolo gracili 5 mm. longo supra canaliculato suffulta. *Cymae* terminales, saepe etiam ex axillis superioribus ortae, pauciflorae, floribus basi articulatis paululo post anthesin 1.3 cm. longis; bracteae deciduae. *Receptaculum* elongatum, ad ovarium paululo ultra 1 mm. diametro, supra ovarium ad 3 mm.

diametro subitius expansum. *Calycis* segmenta saepissime cito decidua, circa 1.5 mm. longa et lata. *Stylus* inferne incrassatus; ovarium 2-loculare.

Satul, Klawng Ton, 300 m., evergreen forest, *Kerr* 14444.

Eugenia spissa *Craib* [Myrtaceae-Myrteae]; inter species foliorum nervis lateralibus numerosis approximatis et inflorescentia brevi axillari *E. refertae* Craib maxime affinis a qua nervis lateralibus quam reticulatione multo magis conspicuis recedit.

Arbor circa 7 m. alta (ex *Kerr*), glabra; ramuli graciles, cortice brunneo vel mox cinereo-brunneo obtecti. *Folia* opposita vel subopposita, oblonga, apice obtuse caudato-acuminata, basi cuneata vel late cuneata, saepe parum inaequilateralia, 5-11 cm. longa, 2-4.8 cm. lata, rigide chartacea, sicco subtus luteo-viridia, pagina inferiore, punctata, nervis lateralibus utrinque numerosis rectis supra subobscuris subtus subprominulis, costa supra impressa subtus prominente, nervis transversis paucis subtus vix conspicuis, nervo intramarginali circa 1 mm. intra marginem supra obscuro subtus subprominulo, margine anguste cartilaginea vel saepe vix distincte cartilaginea, interdum recurva, petiolo 3-5 mm. longo supra canaliculato suffulta. *Cymae* axillares, saepissime petiolo fere duplo longiores, rarius ad 2 cm. longae, pauciflorae, pedunculo communi 2-6 mm. longo suffultae; bracteae ad cymularum bases circa 1.5 mm. longae; pedicelli ad 1.75 mm. longi, basi bractea solitaria 0.75 mm. longa et apice bracteolis duabus circa 0.5 mm. longis instructi; alabastra turbinata, 4 mm. longa, apice 4 mm. diametro. *Corolla* ut videtur calyptratim decidua.

Chumpawn, Tasan, 75 m., by stream in evergreen forest, *Kerr* 11666.

Eugenia sublaeta *Craib* [Myrtaceae-Myrteae]; ab *E. laeta* Ham., cui habitu similis, foliis minoribus, floribus saltem inferioribus axillaribus recedit.

Frutex circa 3 m. altus (ex *Kerr*), partibus omnibus glaber; ramuli primo parum compressi, brunneo-corticati, mox subteretes, cortice cinereo-brunneo obtecti, lenticellis haud conspicuis. *Folia* opposita vel subopposita, saepissime elliptica vel oblongo-elliptica, obtuse acuminata, basi cuneata, 4.5-5.5 cm. longa, 2-3 cm. lata, chartacea vel rigide chartacea, sicco viridia vel plus minusve brunnescentia, pagina utraque sat copiose punctata, nervis lateralibus utrinque numerosis inter se 3-4 mm. distantibus rectis pagina utraque prominulis intra marginem anastomosantibus nervum intramarginalem continuum formantibus, nervulis pagina utraque rete subprominulum vel saltem conspicuum formantibus, margine cartilaginea, anguste recurva, petiolo ad 5 mm. longo supra anguste canaliculato suffulta. *Inflorescentia* e floribus in axillis supremis positis et cymula triflora terminali constituta; pedicelli inferiores infra articulationem ad 2.5 cm. longi, apice bracteolis duabus deciduis instructi, flore terminali saepissime subsessili. *Receptaculum*

cylindricum, 1.5 cm. longum, superne gradatim paululo incrassatum, medio circa 2-2.5 mm. diametro, summo apice ad 7 mm. diametro expansum, sicco fuscum. *Sepala* 4, plus minusve transverse oblata, 1-2 mm. longa, 4.5-6 mm. lata, saltem interiora marginem versus membranacea. *Petala* 4, inter se libera, in alabastro circa 7.5 mm. longa et lata, sat copiose glandulosa, medio crassiora. *Ovarium* 2-loculare.

Ranawng, Kao Pawta Luang Keo, 1300 m., open evergreen on ridge, *Kerr* 16951.

***Barringtonia abbreviata* Craib** [Lecythidaceae]; a *B. conoidea* Griff. eiusque affinioribus foliis longius petiolatis et inflorescentia brevi rigida erecta distinguenda.

Arbor circa 8 m. alta (ex *Kerr*), glabra; ramuli primo stramineo-brunnei, mox pallide brunnei vel brunneo-cinerei, plus minusve striatuli vel reticulato-striatuli, lenticellis haud conspicuis. *Folia* ad ramulorum apices aggregata, oblonga vel oblongo-oblancoolata, apice subacutem acuminata, basi cuneata vel subacuminata, interdum decurrentia, saepe parum inaequilateralia, 9-24.5 cm. longa, 3-9 cm. lata, chartacea, sicco viridia, nervis lateralibus utrinque 9-10 bene intra marginem anastomosantibus supra conspicuis subtus prominulis, nervis transversis pagina utraque conspicuis vel subprominulis, nervulis reticulatis, margine distanter denticulata, parum recurva, petiolo 1-5 cm. longo basi conspicue incrassato suffulta. *Spicae* infra folia ortae, solitariae vel geminae, pedunculo communi circa 1 cm. longo incluso ad 7 cm. longae, rigidae, erectae, nodis prominentibus sat proximis, rhachi sub anthesin brunnea vel fusco-brunnea circa 4 mm. crassa; bractae deltoideae, circa 1.5 mm. longae, deciduae. *Receptaculum* sub anthesin circa 1.3 cm. longum, parte basali pseudopedicellum 5-7 mm. longum formante, superne incrassatum, subangulatum. *Calyx* 7-9 mm. longus, in lobos 2-4 irregulariter rumpens. *Petala* 4, punicea (ex *Kerr*), suboblonga, plus minusve cucullata, circa 3 cm. longa et 1.5 cm. lata. *Filamenta* basi inter se connata, exteriora 3.5 cm. longa, antheris circa 0.75 mm. longis, interiora multo breviora, antheris 1.25 mm. longis breviter apiculatis, connectivo lato. *Stylus* 3 cm. longus; ovarium 4-loculare, ovulis in loculo quoque circa 12 biseriatis.

Pang-nga, Kao Pang-nga, 100 m., evergreen forest, *Kerr* 17226A.

***Barringtonia kratensis* Craib** [Lecythidaceae]; a *B. longipede* Gagnep. foliis latoribus conspicue serrulatis vel denticulato-serrulatis, racemis laxifloris, calycis lobis brevioribus distinguenda.

Arbor circa 4 m. alta (ex *Kerr*); ramuli annotini glabri vel subglabri, angulati, stramineo-corticati, lenticellis vix conspicuis. *Folia* ad ramulorum apices aggregata, late lanceolata, oblongo-lanceolata, rarius suboblonga, apice longius acuminata, apiculata, basi acuminata vel acuminato-cuneata, parum decurrentia, 8-25 cm. longa, 3.3-8.3 cm. lata, rigide chartacea, sicco viridia, matura pagina utraque glabra, costa supra sicco anguste subacute prominente

subtus prominente, nervis lateralibus utrinque 12-19 intra marginem anastomosantibus supra impressis vel prominulis subtus prominentibus, nervulis rete gracile pagina utraque prominulum efficientibus, margine serrulata vel denticulato-serrulata, petiolo 2-10 cm. longo basi conspicue incrassato suberoso apice lamina decurrente anguste alato glabro suffulta. *Inflorescentia* spicata vel racemiformis, solitaria, ramulos terminans vel rarius e ramulis vetustioribus lateraliter orta, pedunculo communi circa 2 cm. longo incluso circa 35 cm. longa, rhachi cum pedunculo communi conspicue angulata vel hic et illic subalato-angulata glabra sicco viridi mox straminea partibus iuvenilibus plus minusve fusciscente, pedunculo basi bracteis dense aggregatis deciduis instructo; bractee deciduae. *Receptaculum* glabrum, circa 3 mm. longum et apice 4 mm. latum, basi in pseudo-pedicellum vix conspicuum vel usque ad 1 cm. longum angustatum. *Calycis* segmenta 4, oblonga vel oblongo-rotundata, ad 6 mm. longa et 5 mm. lata, sparse crassius ciliata, aliter glabra. *Petala* 4, oblongo-elliptica, apice rotundata, circa 1.5-1.8 cm. longa et 1 cm. lata, medio incrassata, margine superne reflexa, basi saepe inflexa, glabra. *Stamina* circa 2 cm. longa. *Stylus* 2.5 cm. longus; ovarium 4-loculare.

Krat, Baw Rai, 100 m., evergreen forest, *Kerr* 9456.

Osbeckia pulchra *Geddes* [Melastomaceae-Osbeckieae]; ab *O. crinita* Benth. receptaculo supra ovarium multo longius tubuloso-producto, fructu ambitu oblongo haud rotundato, ab *O. Garrettii* Craib receptaculo superne appendicibus penicellato-setosis instructo recedit.

Frutex erectus; ramuli quadrangulares, sulcati, pilis pallidis rigidis patentibus basi bulbatis instructi. *Folia* oblongo-lanceolata vel oblongo-elliptica, apice acuta, basi lata vel obtusa, 6-11 cm. longa, 2.5-4 cm. lata, chartacea, sicco viridia, subtus pallidiora, supra pilis longis subsparse tecta, subtus ad nervos nervulosque pilis albis rigidis copiose instructa, margine ciliata, e basi 7-nervia, nervis marginalibus tenuibus, omnibus supra impressis subtus prominentibus; petioli 5-9 mm. longi, dense hirsuti. *Inflorescentia* terminalis, umbellato-cymosa, laxa, pedunculo pubescente suffulta; pedicelli 2-3 mm. longi. *Receptaculum* setis inferne simplicibus superne stellatis et appendicibus penicellato-setosis sat crebris instructum, supra ovarium longius tubuloso-productum, circa 1 cm. longum. *Calycis* segmenta 4, linearia, 4-5 mm. longa, setis paucis margine instructa, apice stellato-setosa, appendicibus similibus sed dimidio brevioribus alternantia. *Petala* 4, rotundato-oblonga, 1.5 cm. longa, 1.1 cm. lata, ciliata. *Stamina* 8, inter se aequalia; antherae apice attenuatae; filamenta 1.2 cm. longa. *Ovarium* circa 9 mm. diametro, apice setosum, quadriloculare; stylus 2.2 cm. longus.

Doi Sutep, 1600 m., *Kerr*.

Osbeckia watanae *Craib* [Melastomaceae-Osbeckieae]; *O. nepalensi* Hook. habitu similis sed antheris acuminatis haud gradatim attenuatis facile distinguenda.

Ramuli quadranguli, setis erectis adpressis pallidis basi incrassatis scabridi, straminei, ad angulos virides. *Folia* lanceolata angustave oblongo-lanceolata, apice obtusa, basi rotundata vel cordatula, 3–8 cm. longa, 1–1.5 cm. lata, chartacea, pagina superiore viridia vel fusco-viridia, inferiore pallidius viridia, supra setosa, subtus ad nervos setosa, aliter pilis sat longis plus minusve adpressis subrigidis instructa, e basi 5–7-nervia, nervis duobus exterioribus tenuibus, aliis supra parum impressis subtus prominentibus, nervis transversis fere omnino obscuris, margine longius ciliata, subintegra, sessilia vel petiolo ad 2 mm. longo adpresse setoso suffulta. *Flores* terminales, congesti; bracteae subovatae, acutae, 5 mm. longae, 3 mm. latae, dorso medium versus adpresse setosae, margine longius setoso-ciliatae; pedicelli subnulli. *Receptaculum* circa 9 mm. longum, ima basi setosum, medium versus processibus paucis carnosius quadrato-oblongis circa 1 mm. longis apice longe setosis et apice cum calycis segmentis alternantibus processibus similibus 1.5 mm. longis ornatum, aliter glabrum. *Calycis* segmenta 4, oblongo-lanceolata, acuta, 1 cm. longa, fere 5 mm. lata, margine setoso-ciliata. *Petala* 4, flabelliformia, paulo ultra 2 cm. longa, 2.5 cm. lata, pauperius ciliolata. *Stamina* 8, inter se aequalia, filamentis 1 cm. longis, antheris 9 mm. longis in acumen loculis paulo brevius productis, connectivo basi paululo producto.

Watana, *Put* 1909.

Otanthera confusa Craib [Melastomaceae-Osbeckieae]; ab *O. moluccana* Blume receptaculi setis multo longioribus recedit.

Suffrutex circa 0.75 m. altus (ex *Kerr*); ramuli setis erectis adpressis primo rubris cito fusco-rubris iuventute tecti, mox cinereo-corticati, angulati, 2–3 mm. diametro, sparsius similiter setosi. *Folia* opposita, paribus inter se aequalibus parumve inaequalibus, lanceolata, vel oblongo-lanceolata, apice acuta, basi cuneata, 2.5–7.5 cm. longa, 0.8–2.1 cm. lata, rigide chartacea, sicco viridia, pagina inferiore pallidiora, supra setis adpressis saepe primo apice rubro-tinctis scabrida, subtus setis longioribus tenuioribus adpressis instructa, 5-nervia, e basi trinervia, nervis duobus exterioribus paululo supra basem furcatis, nervis supra argute impressis subtus prominentibus, nervulis supra obscuris subtus paucis magis minusve conspicuis, margine subintegra, petiolo ad 7 mm. longo longius adpresse setoso suffulta. *Inflorescentia* 3–5-flora, et terminalis et ex axillis supremis orta, subsessilis vel pedunculo communi sub fructu ad 1 cm. longo suffulta; pedicelli infructescentes circa 4 mm. longi; bracteae deciduae. *Receptaculum* 4 mm. longum, supra ovarium tubuloso-productum, dorso setis elongatis rubro-tinctis ima basi paucis solitariis superne saepissime per 5 processibus carnosius brevibus subquadratis gestis tectum praeterea sparse inconspicue puberulum, intra glabrum. *Calycis* tubus circa 0.3 mm. longus, apice intra puberulus, segmenta subulata, 4 mm. longa, longe rubro-setosa, processibus circa 1 mm. longis apice similiter setosis alternantia. *Petala* 5, purpurea (ex *Kerr*), cuneata, apice

truncata, medio breviter acuminata, ad 8 mm. longa et 7 mm. lata, ciliata et ad acumen setis paucis elongatis instructa. *Stamina* 10, inter se subaequalia, filamentis 3·5 mm. longis, antheris 3–3·5 mm. longis, brevioribus sub antheram ipsam longioribus 0·5 mm. infra antheram bi-appendiculatis. *Ovarium* apice longe et dense setosum; stylus 7 mm. longus. *Fructus* fere maturus subglobosus, 7 mm. diametro, setis persistentibus instructus, receptaculo subcarnoso, parte apicali libera capsulari longitudinaliter fissis; semina curvata, circa 0·5 mm. longa, punctata.

Ranawng, Kao Pawta Chongdong, 800 m., evergreen forest, *Kerr* 16763.

Chirita capitis Craib [Gesneriaceae-Cyrtandreae]; a *C. involucrata* Craib et *C. involucellata* Craib antheris glabris recedit.

Herba annua, ad 45 cm. alta; caulis simplex vel e basi ramosus, basi ad 8 mm. diametro, pilis pallidis transverse septatis divergentibus sparse instructus, viridis vel praesertim supra nodos rubro-tinctus. *Folia* opposita, paribus saepe inter se parum inaequalibus, saepissime oblonga vel suboblonga, apice acuta vel acute subacuminata, basi saepissime inaequilateralia, latere altero rotundata, altero rotundata vel cuneato-rotundata, ad 8 cm. longa et 5 cm. lata, pagina superiore viridia, inferiore pallide viridia, utraque sed inferiore sparsius pilis erectis pallidis transverse septatis instructa, nervis lateralibus utrinque 6–7 supra parum impressis subtus prominentibus, costa supra impressa subtus prominente, margine integra, ciliata, petiolo 1–6·5 cm. longo supra parum canaliculato saepe rubro-tincto parcius piloso suffulta. *Cymae* axillares, saepissime 3-florae, pedunculo communi subnullo vel saepissime 5–10 mm. longo indumento ei caulis simili tecto apice bracteis duabus inter se haud connatis foliaceis sessilibus circa 10 mm. longis et 6 mm. latis instructo suffultae; pedicelli 10–12 mm. longi, pilis pallidis divaricatis glanduloso-capitatis instructi. *Calycis* viridis segmenta lineari-lanceolata, subacuta, apice breviter recurva, 6 mm. longa, 1·25 mm. lata, dorso pilis elongatis transverse septatis glanduloso-capitatis subsparsae tecta. *Corollae* tubus extra superne pilis brevioribus glanduloso-capitatis instructus, 14 mm. longus, medio parum curvatus, parte basali aequali 2·5 mm. diametro, apice ad 7 mm. diametro ampliatus; limbus pallide violaceus, oculo purpurascens; labium inferius 3-lobatum, lobo mediano lateralibus paulo maiore ad 6 mm. longo et 7 mm. lato; labium superius e lobis duobus 4 mm. longis et 5·5 mm. latis constitutum. *Stamina* 2, antheris omnino glabris dorso basi et apice fusco-purpureis, filamentis 3 mm. longis 7 mm. supra corollae tubi basem insertis; staminodia lateralibus 2, filiformia, apice haud pilosa. *Ovarium* sessile, viride, glabrum, basi disco circa 0·5 mm. alto cinctum, circa 8 mm. longum, stylo pallido circa 5 mm. longo pilis paucis tenuibus glanduloso-capitatis instructo, stigmate bilamellato, lamellis recurvis supra papillosis.

Described from plants raised in Aberdeen from seed collected in Bangkok by Dr. A. F. G. Kerr. Flowered November 1928.

Chirita oculata Craib [Gesneriaceae-Cyrtandreae]; a *C. barbata* Sprague, *C. tubulosa* Craib, earumque affinioribus corollae oculo brunneo vel fusco-brunneo recedit.

Herba annua, caule erecto 30–70 cm. alto ramoso viridi basi ad 1.3 cm. diametro pilis longiusculis transverse septatis albis divergentibus sat rigidis primo instructo mox plus minusve glabrescente. *Folia* elliptico-ovata vel elliptico-oblonga, inferiora apice acuta vel acute subacuminata, basi rotundata vel superiora cordatula, inferiora ad 20 cm. longa et 13.5 cm. lata, superiora circa 9 cm. longa et 5.5 cm. lata, supra viridia, subtus pallida, supra pilis longioribus transverse septatis et brevioribus sat rigidis instructa, subtus ad costam nervosque laterales aliter sparsius similiter instructa, nervis lateralibus utrinque 11–14 supra parum impressis subtus prominentibus, petiolo usque ad 4 cm. longo suffulta, superiora fere sessilia, ramis axillaribus oblique erectis cauli similibus cum petiolo basi concretis. *Racemi* axillares, pedunculo communi cum petiolo omnino concreto, pedicellis ad petioli summum apicem oreuntibus circa 1 cm. longis viridibus pilis longiusculis transverse septatis pallidis instructis sub anthesin erectis. *Calyx* pallide viridis, dorso et intra apice pilosus, segmentis lineari-lanceolatis subacutis ad 13 mm. longis et 2 mm. latis. *Corollae* tubus inferne pallidus, superne lutescens, dorso inferne glaber, superne pilosus, intra inferne glaber, superne pilis brevibus glanduloso-capitatis instructus, circa 1.2 cm. longus, inferne ad 8–9 mm. tubulosus, circa 1.75 mm. diametro, apice ad 5.5 mm. diametro expansus, intra apice brunneus vel fusco-brunneus; limbus 5-lobatus, lobis imbricatis oblatis, infimo 6 mm. longo 8 mm. lato, lateralibus 4 mm. longis 7 mm. latis, supremis 2.5 mm. longis 5 mm. latis. *Stamina* 2, filamentis circa 1.5 mm. longis pilis paucis instructis circa 8 mm. supra corollae tubi basem insertis, antheris coalitis pallidis apice pilis purpureis instructis. *Ovarium* sericeum, basi disco conspicuo unilaterali instructum, stipite quam disco longiore glabro suffultum; stylus pubescens, apice bilamellatus, lamellis piliosis.

Described from a plant which flowered at Aberdeen in July 1928. It was raised from seed of *Kerr* 9750 which was collected on Kao Sakan.

The corolla limb is lemon-yellow and the throat brown or dark brown.

Polypodium (Goniophlebium) Garrettii C. H. Wright [Filices-Polypodiaceae]; *P. niponico* var. *Wattii* Bedd. proximum, frondibus angustioribus longioribus velutinis pinnisque pluribus acutis distinguendum.

Rhizoma late repens, 3 mm. diametro, ramentis anguste lanceolatis brunneis deciduis vestitum. *Stipes* 2.5 cm. longus, stramineus, tenuis, glaber. *Frondes* oblongae, usque ad 32 cm. longae, alte pinnatisectae, utrinque velutinosae; pinnae basi confluentes, oblongae, acutae, 2.5 cm. longae, 5 mm. latae, utroque latere rhachidis circiter 50; sori uniseriati.

Doi Angka, Doi Pa Mawn, 1720 m., *Garrett* 382.

XVIII.—MISCELLANEOUS NOTES.

The following appointments have been made by the Secretary of State for the Colonies :—DR. W. YOUNGMAN, Economic Botanist, Central Provinces, India, to be Director of Agriculture, Ceylon ; MR. F. BURNETT, Divisional Agricultural Officer, Ceylon, to be Deputy Director of Agriculture, British Guiana ; DR. F. J. MARTIN, Agricultural Chemist, Sierra Leone, to be Assistant Director of Agriculture, Sierra Leone.

DR. ERYL SMITH. We deeply regret to record the death on January 25th, as the result of a motor accident, of Dr. Eryl Smith, who for more than two years had worked intermittently in the Herbarium on the Ferns of Malaya. Educated at University College, Bangor, the London School of Medicine for Women, and the Royal Free Hospital, Dr. Eryl Smith took the degrees of M.B. and B.S. of the University of London in 1918, and, after holding medical appointments at home and abroad, married Dr. Malcolm Smith, who at that time was in practice at Bangkok. Proceeding to Siam she was attracted to the study of the flora and early commenced to specialize on the Pteridophyta. She visited the Nakawn Sritamarat Mountains in the Siam Peninsula, the Kam Chay mountains in Cambodia, and the Five Finger Mountains in Hainan, and later spent six months in the Malay Archipelago chiefly in Celebes and Timor. In all these countries Dr. Eryl Smith made collections of ferns, many of which she presented to Kew. She published a paper on the ferns of Kaw Tao, Surat, and had in view a complete work on the ferns of Siam.

The Otari Open Air Museum, Wellington, New Zealand.—

In the *Kew Bulletin* for 1926 (p. 428) and 1929 (p. 63), brief accounts were given of the establishment of this Museum as a reserve for the native vegetation of New Zealand.

We now record with pleasure the fact that DR. L. COCKAYNE, C.M.G., F.R.S., has been appointed Honorary Botanist to the Wellington City Council. This appointment, which will ensure that Dr. Cockayne's knowledge and advice are fully utilised in the management of the Museum and other reserves, is, we believe, the first of its kind to be made by any City. It is welcome evidence of the care with which the project is being carried out, and should ensure that its development will proceed along sound lines.

***Strychnos chloropetala* A. W. Hill.**—A new species of *Strychnos*, *S. viridiflora* A. W. Hill, was published in *K.B.* 1925, p. 424, but it was unfortunately overlooked that Dr. De Wildeman had previously used this name for a species collected in the Belgian Congo (De Wild. in *Plant. Bequaert.* ii. p. 101, 1923). It is therefore necessary to give the Siamese species another specific name and *Strychnos chloropetala* A. W. Hill is now substituted for *S. viridifolia* A. W. Hill.

In addition to *Kerr* 6005, from Mê Wong, Nakansi Sawan, the type specimen of *S. chloropetala*, the following additional specimens, which have been arranged in their circles according to the order adopted in Prof. Craib's *Florae Siamensis Enumeratio*, may now be placed in this species.

SIAM.

Maharat.

Prê, Hui Mê Kammi, 300 m., woody climber, edge of stream on limestone, *Kerr* 4843. Lampang, Mê Long, 170 m., the berry is said to be about 1 cm. in diameter and the seed is used for clearing muddy water, *Winit* 802. Lampang, Mê Puyang, 190 m., flowers greenish-white, *Winit* 1284. Lampang Mê Yom, 100 m. (Vernacular name Tûng Kûa Kam. tua mê), straight spines, greenish-white flowers, *Winit* 1629.

Rachasima.

Korat, Chantûk, Tachang, 400 m., climber, rocky limestone hill, *Kerr* 10,049.

Rachaburi.

Kanburi, Wangka, 200 m., scrambling shrub growing among limestone rocks, *Kerr* 10,474.

Surat.

Chumpawn, Kaw Wieng, 50 m., *Kerr* 11,372.

Kaw Tao, 10 m., woody climber, flowers green, *Kerr* 12,726.

Kaw Tao, 20 m., *Kerr* 11,136.

Kaw Tao, 300 m., (?) *Kerr* 16,080.

Kaw Prap, 10 m., *Kerr* 12,522.

Puket.

Pang-nga, Kao Taknan, on rock of limestone hill, *Kerr* 17,285.

Nakawn Sritamarat.

Patalung, Kao Oktalu, 100 m., woody climber on limestone hill, *Kerr* 15,359 (flowers slightly larger than in the type).

Flora of Trinidad and Tobago.*—The second part of the first volume of this flora has now been published (*K. B.* 1929, p. 92). This continues to follow the order of the cohorts of the Genera Plantarum, and reaches the end of the *Geraniales*. The order of the families is not always that of the Genera Plantarum, and some genera are placed in different families, e.g. *Sauvagesia* in Ochnaceae. A few new species and several new combinations are published here for the first time. As before, the typescript was carefully checked at Kew.

* Flora of Trinidad and Tobago, Vol. 1, Part 2, pp. 23–164; Parietales, Polygalinae, Caryophyllinae, Guttiferales and Geraniales by R. O. Williams, Malvales by R. O. Williams and E. E. Cheesman. Trinidad: printed by the Government Printer, Government Printing Office, Port of Spain. Price 6s.